

Understory Science:
Poems and Brief Essays

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Abstract:

In the face of current environmental crises, it is important to be conscious of the language used in scientific theories. The way we talk and write about the natural world affects our relationship with it and with each other. For the Nature in Words Fellowship I created a portfolio of creative writing that explores the overlap between ecology and ethics, focusing on time spent assisting with research at the Cedar Creek Institute. To achieve this I read relevant literature in both creative and scientific fields. I hoped to integrate the structures and metaphors of scientific writing with those of poetry, for a final product that captures the emotionality and subjectivity of science.

Introduction:

I recently bought a book entitled *The Best American Science and Nature Writing 2008*. The title piqued my interest (the ten cent price tag at the thrift store also caught my eye). After all, what qualifies as the “best” science writing surely depends on the judge; people write about science in just about every possible style, from creative nonfiction pieces to formal research papers, and two pieces of writing could communicate identical information in extremely different ways. The “Best American Science” series embraces this massive variety in the genre. Articles range from a good old fashioned adventure story about a linguist investigating an unusual language in the heart of the Brazilian rainforest, to speculations about the role of dark energy in the universe, to essays that some would probably not even classify as scientific writing at all, such as a rant about our culture’s obsession with multitasking. What all the articles do have in common is a deep curiosity about the world. People investigate what most fascinates them. In reading the

stories of the people behind the research, it becomes clear that science is a very human endeavor.

Telling the stories behind supposedly cut-and-dried research projects is what I set out to do in my poetry project this summer. As a biology student, I have learned through experience that the scientific world, far from a collection of settled facts, is a kind of community, rife with feuds, crusades, and ideological battles. In most of the science classes I have taken, professors approach the material as if it is completely objective, as if scientists somehow operate outside the realm of human experience. It was not until I took an ecology class and read Aldo Leopold's idea of a "land ethic" that I realized what should have been obvious all along – science is not objective. It is influenced by human lives and values, embedded in a cultural context.

One way I set out to examine the cultural context of science was through the dissection of scientific language. I found that the language we use when we talk about ecology often reflects cultural values. For example, as ecologist and philosopher Ricardo Rozzi has pointed out, the Darwinian phrase "survival of the fittest" suggests competition as the natural state of being between nations and individuals, and has been used to justify a capitalist economic system. But other metaphors, like that of nature as a "web of life," have been used as ideological backing for more non-anthropocentric philosophies that seek to recognize the intrinsic value of all living things (Rozzi 919). One recent trend I have encountered is the use of economic language in science. Researchers put dollar values on "ecosystem services," such as natural groundwater filtration by forest root systems, or the oxygen produced by a deciduous forest, in an attempt to assign them legitimate value in today's economic system. The researchers bestowing numeric worth

on environments realize that many services provided by the natural world are impossible to measure in dollars, like the feeling of peace found only in a wild place. Yet by speaking of the natural world in terms of dollars and cents, they are able to influence laws and regulations to account for often overlooked environmental costs (Farber et al. 387).

Beyond influencing formal policies, the way we speak and write about the natural world influences how we interact with it and vice versa. This can be observed in everything from the plants we choose to plant in gardens to the landscapes we romanticize. People may band together to defend a beautiful mountain range but neglect a less dramatic marshland, even if the latter has greater ecological significance. Or they may seek to preserve what they imagine is pristine “wilderness” while marginalizing or erasing the people who actually live on the land, as occurred with the American National Park system and its native inhabitants (Cronon 69-90). Our biases and motivations are important to acknowledge in the face of current environmental crises, as we seek ethical solutions to extinction, pollution, global warming, energy needs, and environmental social justice issues.

For the Nature in Words Fellowship I created a poetry collection to explore this overlap between ecology and ethics, science and culture. I spent the summer assisting student researchers at the Pierce Cedar Creek Institute, but wrote about the experience in a non-traditional way. I tried to write holistically, recognizing that all ecological work is inevitably tied to the thoughts, feelings, and values of individuals. By integrating the metaphors and structures of scientific writing with figurative language and poetic structures, I hoped to make it clear that scientific writing is, to some extent, always an exercise in creative writing.

Methods:

I researched, wrote, and edited my poetry project at Pierce Cedar Creek Institute from June 16th to September 2nd. I spent weekdays living at the Institute, and weekends in Kalamazoo, where I met with my mentor Diane Seuss about once a week.

Reading was a crucial part of my writing process at Pierce Cedar Creek. Before writing I read narratives that combine personal history with scientific or natural observations, including *The Lives of a Cell* by Lewis Thomas, *Pilgrim at Tinker Creek* by Annie Dillard, *A Sand County Almanac* by Aldo Leopold, and *Refuge: An Unnatural History of Family and Place* by Terry Tempest Williams. Many of my poems were directly influenced by these authors and their efforts to capture experience through descriptive writing, among them “Atoms,” “Meadow Lodge,” and “Mauve,” all of which contain an “I” speaker and are reflections on personal encounters with the natural world.

Throughout the duration of the project I sought inspiration from contemporary poets as well, reading collections of poetry that comment on science in relation to human beings, including *Life on Mars* by Tracy K. Smith, *Toxic Flora* by Kimiko Hahn, and *Dearest Creature* by Amy Gerstler. I chose these poets because of their ability to connect the human and natural worlds in their work. For example, in *Dearest Creature* Gerstler gives advice from a caterpillar, alternating straightforward lines such as “rely on your antennae” with more enigmatic statements that could easily apply to human experience, like, “don't get sentimental/about your discarded skins.” I tried to mimic this playful approach in my collection, using a mix of specific details and broader conclusions to connect the human with the other.

Among the nonfiction texts I read this summer, Theodore Brown's book *Making Truth: Metaphor in Science* was especially helpful in teaching me about the way scientists extend metaphors into models. Brown concludes that every scientific model is metaphorical by nature, and each serves to both highlight and obscure certain aspects of the system it aims to describe. He uses the example of the different ways we envision molecules: the "ball and stick" model shows the fixed distances between atoms, but presents them as hard spheres, failing to show their varying radii. On the other hand, the "space-filling" model depicts the outer radii of atoms, but obscures their chemical bonds. All models communicate some aspect of their target system, and all communicate some things better than others. Furthermore, he concludes that because models paint metaphorical pictures of the world, they influence future research directions. A good scientific model may inspire new and interesting questions, while a bad one may stifle creativity and limit new directions (Brown 23).

When writing, I thought about the ways in which metaphor is essential to both poetry and science, and tried to find the overlap. One example is the poem "Fitness." I took the scientific term "fitness," meaning an individual's ability to survive and reproduce, and tried to parse through associations with the word, both scientific and non-scientific, including language surrounding exercise and self-improvement. It is impossible to remove associations like these from scientific terms, which are almost always rooted in everyday language and experience. Using a word like "fitness" to model the way creatures pass on their genes serves to both illuminate and obscure truths about evolution, because as a metaphor it comes with this cultural baggage. Brown's insights about the connections between metaphor and science allowed me to ask questions about

what this baggage was, and what exactly it illuminated and obscured in the context of different ecological models.

Of course, reading a book or article, no matter how engagingly written, is no substitute for experience itself. Throughout June and July I also pursued experiences that would help me understand the science being done at the Institute and the people “behind the scenes.” I wanted the opportunity to observe science, but also to get my hands dirty. I dried ethanol-soaked bees with a hairdryer, set traps for fingerprinting raccoons, stalked snakes in the swamp, and helped a class of children net insects, among many other endeavors. When I did not fully understand a technique or a concept, conversations with peers at meals or out in the field helped me clarify and expand my own understanding.

The actual writing process varied from week to week. I wrote about a poem a day from Monday to Thursday, and then spent the weekend editing and ordering the collection. On a typical weekday I would go out into the field with a research team in the morning, write in the afternoon, and read in the evening. I sent all first drafts to my mentor Diane Seuss, who promptly responded with comments and critiques. Each poem went through several drafts based on Di’s feedback and my own dissatisfactions as I returned to them throughout July and August. I determined the structure of the final collection in August, ending with a total of sixty-five pages.

Results and Discussion:

My favorite moment of the summer occurred late one morning when I was throwing up everywhere. To add to my misfortune, I had locked my keys in my car the day before, and was too violently ill that morning to retrieve the spare set my dad mailed

to the Institute. It was a Friday, and I worried about missing the mail and getting stuck in an empty house over the weekend. Thankfully, Lindsay and Melena, student researchers studying water striders and spiders, came to my room to deliver the keys. As I tried to warn them away from my feverish, likely contagious person, their eyes caught on the insect collection on my dresser.

When they walked over to examine the rows of beetles and butterflies and wasps I had pinned to a Styrofoam spreading board, I really started to sweat. Beyond her water strider research, Lindsay was pinning a permanent insect collection for the Institute. I often saw her out insect hunting, huge, serious-looking net in hand. She knew more about insects than anyone I had ever met, able to identify just about anything in a flash. A meticulous, intelligent person, she brought these traits to her pinning, which looked professional and polished. Meanwhile, I had just learned to pin a week or two before. I accidentally tore legs off my beetles and scraped the scales off butterflies. One brown butterfly, wings covered in false eyes, was even missing an abdomen. I suddenly felt embarrassed by my board of little five-legged mutants.

But neither Lindsay nor Melena had anything negative to say about my efforts. “I like your work,” Lindsay said, “you’re good with legs.” She proceeded to give a few critiques that were immensely helpful, showing me how to properly display cicada-killer wasp wings. She told me what many of my finds actually were, including the sensationally named assassin bug. By the end of their visit I was feeling great, in spite of my lurching stomach.

My morning with Lindsay and Melena was exemplary of the best aspects of my summer. I spent my days with people who were vastly more knowledgeable than I in a

variety of subjects, from frog mating rituals to prairie restoration. The skills they taught me – how to pin, how to spot a rattlesnake, how to identify a black oak – are not things I could have learned exactly the same way in any other place, from any other people. The knowledge of my peers went beyond the realm of readable, study-able words and concepts.

My fellow undergrads had what British scientist and philosopher Michael Polanyi calls “tacit knowledge,” meaning knowledge that can only be gained through life experience, like the ability to ride a bike or drive a car. Tacit knowledge, nebulous as memory itself, is impossible to communicate directly – no number of bike-riding-tips will keep a kid from skinning their knees on their first try. The only way to learn is by doing, and the only way to know what to do is to have an experienced teacher.

Luckily, I was surrounded by a gaggle of teachers. Everyone was simply excited to share what they knew, out of a love of science, the natural world, and learning itself. And everyone was hungry to know more. Nate and Jeff, the rattlesnake hunters, took up birding in their spare time, while Cassie, the artist, raised caterpillars in jars and read books about edible plants. Cassie was the one who taught me how to pin, one cloudy Thursday afternoon. Like the bike-newbie, I had a lot of trouble at first, mangling a cute longhorn beetle. Cassie, ever patient, showed me how to select the proper-sized gap in the spreader to extend a beetle’s legs away from its body, and how to secure the legs with pins like little tent stakes.

By the end of the summer I felt like a regular insect-mortician. I knew how to tug a moth wing gently into place without tearing it, I knew the proper pin placement and angles necessary to keep a cicada from spinning on its axis when spreading its wings, I

even knew how to net a honeybee and quickly corral it into a vial without getting stung. I could never have learned these skills without the support of genuinely curious people dedicated to trying new things and sharing experiences.

Desire to share knowledge, the kind gleaned through experience, surely crept into my poetry. I became conscious of this when I found myself writing a series of prose poems that read more like creative non-fiction essays. The pieces can be found in the section of my collection entitled “Methods,” so named for the nature of the poems, which outline how the undergraduates at the Institute actually went about “doing” science. Clarity was important to me when I wrote this section, as I came to the conclusion that the best way to respect my peers would be to present their work in a straightforward manner. I found the bare bone *ideas* behind the research fascinating, and wanted to simply lay them out for the reader.

However, I soon found that summing up a scientific study in a page or two of prose is not at all simple, and complex cultural and biological phenomena, like the crusade against invasive species, are nearly impossible to lay out in neat lines. It was extremely challenging for me to grapple with the inaccessibility, ambiguity, and controversy inherent in science and scientific language.

Ecology is an especially messy art, as ecologists must juggle countless variables impossible to control in a lab. Studies can be confusing, even to those with a background in science. Designing one demands expertise in very specific topics relevant to the research, and researchers have to do a boatload of work before they ever push that first pH probe into a forest floor. As I tailed researchers, I worried a little about misunderstanding or misrepresenting their work.

Similarly, some scientific papers are inaccessible to all but those with specialized knowledge. I recall spending many, many hours puzzling my way through published scientific papers in classes that required “journal club” presentations. Scientific inaccessibility is one topic I attempted to address in the project, namely in the poem “Feeding practices (the reasons we eat each other),” and its sister poem “Feeding practices: a glossary of terms.” The first utilizes intentionally obscure words like ‘lepidophagy,’ ‘osteophagy,’ and ‘trophallaxis,’ while the second offers definitions, but leaves it up to the reader to choose how to define and interpret words.

I found that ambiguously defined words are common in the scientific community, where new words are constantly being born alongside new theories. The words chosen ultimately have consequences. For example, the meaning of the term “invasive species” is highly disputed among scientists. Some use the term as a blanket word for all non-indigenous species, while others use it to describe only those non-indigenous species deemed to have adverse effects on a habitat. Using it to cover several biological phenomena obscures the true complexity of the issue: density and range of a non-indigenous population varies greatly depending on the biotic and abiotic factors of a particular place, and the underlying processes at work (Colautti & MacIsaac 135-141). In other words, there are many, many factors involved, and glossing over these factors paints an inaccurate picture of the world.

Part of my project was looking at the perception of science in a cultural context, too. To stick with the previous example, I found the over-simplification of invasive species had consequences beyond the realm of scientific literature. The militaristic terms have entered the general public’s consciousness, as many conservation groups have

openly declared war on invasive species. Subjective words like “invasive,” “foreign,” “transient,” “exotic,” and “immigrant,” all used to vilify non-indigenous species, have social and cultural connotations (Larson 169-171). In 2005, Rush Limbaugh compared illegal immigrants to invasive “mollusks and spermatozoa” claiming they would “clog up” the country. Scientific language is powerful because it is perceived as objective and factual, but it can be, and is, used ideologically.

Writing about complex issues like the language used to describe non-indigenous species was the most challenging aspect of my summer, because there are no easy solutions, no way to present the issues simply. Invasive species *have* harmed biodiversity across the world, and that *should* be addressed and understood by scientists and non-scientists alike (Allendorf & Lundquist 24-30). But we should also all understand how scientific rhetoric can be used to obscure rather than reveal complexities. We make judgments about what we value in the nature we choose to preserve and the language we use to describe it, and there is not always a right or wrong answer. In the piece “Burns,” I describe the prairie as “a new construction from the old,” hoping to call attention to the ways in which what we call nature has, in many respects, become a human construction.

I ultimately found ecology to be messy the way life is messy, irreducible the way an experience is irreducible. I tried to put observation at the heart of my poetry, because it lies at the heart of science, too, the desire to experience the world deeply and share that experience with others. The most beautiful parts of my summer were spent outdoors, knee-deep in muck, learning tacit but tangible truths about the world. The most challenging were spent puzzling over environmental questions that are complex,

heartbreaking, and not at all intuitive. The poems that resulted are my attempts at reconciling these myriad joys, fears, and the tensions between them.

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“Within a few weeks now Draba, the smallest flower that blows, will sprinkle every sandy place with small blooms. He who hopes for spring with upturned eye never sees so small a thing as Draba. He who despairs of spring with downcast eye steps on it, unknowing. He who searches for spring with his knees in the mud finds it, in abundance.”

- Aldo Leopold, *A Sand County Almanac*

Abstract

Ecology Deity

She's the wellspring of all queries, miracles, epiphany-flickers, PVC pipe quadrats, show-and-tells.

She's said to be made of dark energy, a handful of her atoms lingering in every liter of air like perfume.

She unravels the universe with her teeth, stretching it like taffy. She smells of O horizon earth and the deepest crevice in a snail's golden spiral. She laughs often, but ultrasonically, like a tickled rat. She's depicted with the tentacles of a cuttlefish,

the breath of a sunflower, the eyes of a human child. She's ugly, but only because she makes you squirm. Her beauty the beckoning array of never-turned stones in the creek. Flip one and she'll vanish in a cloud

of muck, transformed into a black-jawed crayfish in an instant. If you're lucky, she'll model for you. She'll stop slugs from devouring your data, keep your daisy-heads gyrating with her lazy gravity, bestow statistical significance. If you're luckier still,

she'll grant significance that can't be explained mathematically. Legend has it Physics, that stick in the mud, cut out her tongue and buried it deep beneath a red oak. But she grew back fifty more, a medusa mouth that hisses and pecks at the underbelly of the world.

Introduction

Fitness

The puzzle piece suspended in the prism,
the pulpy wool sweater withering in the sun,

the sundry propensities. One hundred identical genes
in one hundred contradictory bodies. Planet

fitness. The oxygen lunging to muscle tissue. The cardio
steps. The fecundity and the hysterics. The febrile

seizures and the fertile land. The internal
breeding. The tomato's slender skeleton,

the avian embryo quaking the egg, the self-contained snake
easily reaching the bicycle pedals. The offspring, looped

like rat tail infinities. Fitness is aptitude,
is both absolute and relative. Isn't lucid, felicitous,

tenderizing. Isn't crying in the shower. Is life as one
big jazzercise session. Tipping its hat up and

kicking. Scanning Pinterest tips for a skinnier waist.
Imperfect fits and starts. The family tree decaying in the babies.

Peacocks collapsing into feathery green graves, keys in locks
turning under the weight of all those feathers.

Uncertainty Principle

Mimosa pudica, fern-like with pink truffula flowers, collapses its leaves when touched, as if tickled, the way petals embrace after deep red waves of light signal sunset.

Contact triggers depolarization, a tiny electric pulse similar to the charges that perpetually flow through our bodies, powering our muscles and minds. Beyond *Mimosa*, all plants know

when they are being touched. The pine you lean on, the grass you pull out in indifferent tufts, the daisy the instant before the pluck. One touch can literally change a plant's genetic makeup.

In the 1960s, Frank Salisbury studied the growth of the cocklebur plant, parent of spiky brown burs that cling to socks after a hike. Every day his team measured leaf lengths with a ruler, noting growth.

And every leaf they touched yellowed and died. All it took was three seconds a day. The study awry, they ended with no data, just a puzzle and perhaps a heightened awareness of thoughtless touches.

A tree recoils from a hug in the only way it can, hiding its shoots within itself like a snail. Its developmental patterns change. It prepares itself for a violent world, strengthening its trunk and flowering late.

Charles Darwin thought he could communicate with plants through music rather than touch. He experimentally played his bassoon for a *Mimosa pudica*, the most reactive plant he knew, hoping it would hear

and its leaves would droop. Nothing happened beyond Charles Darwin feeling foolish, as if caught in the act of meowing at a cat. Collapsible science, sensitive plant.

Voucher Specimen

Defined as: proof of the existence of an organism in a particular time and space.

Includes: frozen tissues, organs in formaldehyde, hair, karyotype slides, photographs, sound recordings.

Should be: non-ephemeral, stable, storable.

If the body of the creature is destroyed while obtaining its DNA sequence the divined code still counts as evidence.

If the species is rare, think twice before swiping. Search instead for appendages, molted skin, vials of blood.

Some shy gods are sampled out of existence.

Founder Effect

The flora and fauna of the Hawaiian archipelago evolved in isolation for 30 million years.

They are the descendants of lost migrating birds, wind-flung insects, seeds swept impossible distances over cold ocean to improbable land.

Few organisms struck sand and fewer survived, making competition slight or nonexistent.

Hawaiian plants grew gentle in loneliness. Roses and raspberries lost their thorns. Mint forgot how to make defensive chemicals.

When humans introduced mainland plants, they diseased, devoured, and out-competed the mild-mannered Hawaiian natives.

In some forests only the largest trees are native. The floor is choked with introduced seedlings, simply waiting for the giants to founder.

What trusting genes, wayward seeds, absent-minded seas.

Artificial Selection

60,000 dogs run wild in the city of Bucharest. If you could somehow spay and neuter 100% of them, it would take 16 years to see any reduction in population. If you sterilized 90%, the population would continue to run astray. Lineages trace to the 1980s, when the communist dictator gave

the order to destroy hundreds of homes, to be replaced by urban sprawl. Shedding domestication, abandoned pet descendants bit thousands. After a four year old boy was devoured alive, the president of Romania roused crowds, declaring *humans are above dogs*. He would kill them all.

If gene pools run through generations like rivers, why be surprised when the water rises? What do we generate when we dam these grand processions of bodies? It would be hard to stay angry at Noah for secretly crushing two delicate mosquitos, two shimmering horseflies

between his thumb and index finger. He would still have crash-landed in the desert. Floods of dogs. Skinny dogs howling like Jehovah.

Junk

This summer Oxford researchers determined over 90% of human DNA *doesn't do a damn thing*. Noncoding “junk” DNA collects like hair in a shower drain. Sequences called transposable elements replicate themselves again and again like viruses, a cancer making up at least half our genome. Even functional genes sometimes double by accident in a new generation. One copy preserves its purpose, while the pseudogene, that dark twin, *mutates unchecked*.

Junk DNA helps explain why genome size varies so extraordinarily between creatures: a human has 8 times more DNA than a puffer fish, but *5 times less* than an onion. This dirty animal secret revealed in conservation: it doesn't matter if junk is copied accurately, so it accumulates mistakes, while essential DNA doesn't change much over millennia. In this way each individual's junk DNA is unique, a molecular fingerprint.

Researchers compared conserved DNA sequences of related species: mice, rabbits, dogs, horses, and humans, finding similar junk-to-useful-gene ratios in each, concluding *existence alone doesn't ensure function*. The *cold-blooded truth*: only 1% of mammal DNA codes for proteins, the yarn we weave into bodies. The other 7 functional percent simply micromanage: turn genes on or off, make a brain a brain and a kidney a kidney from identical cellular instructions.

Humans aren't a special case. Biologically we simply fit the template “mammal,” harking back to that distant ancestor who dared become soft and lovely. We all make the same proteins in our cells, we the resident warm, furry, live-birthing beasts.

* * *

And the 92%!

The unwatched *masses!*

The *passivity!*

The *racket!*

The *latchers!*

The *winglessness!*

Landfill skeleton!

Carbon-cage

rubbish-caked

molecular fingerprints!

unseen selfish jumping genes

the repeat

repeat!

repeat babbling non-body

I mean nonsense-babbling repeat body
wingless

I mean

cancer-caked

rubbish-racket

selfish repeat gene cage I mean unseen

nongenes i mean

mean landfill body

mean genes

Seraphim

In the 1950s and 60s, William D. McElroy paid children by the bucket for live fireflies. He was curious about the brassy trumpet

gold of their flashes. Their chemical sparks a brighter and cleverer concoction than our bulky bulbs, a lightning pulp to squeeze and sever

from the plum-ripe summer sky. Children caught millions for profit, promptly delivered their bodies to be crushed. Dime-heavy pockets

veiling soft, fervent hands. The chemical behind the magic: Luciferin, reacting with oxygen and ATP in a firefly's abdomen.

Luciferin could someday be spread on the soil of distant planets to check for earth-like life. A blaze of light would reveal the presence

of beings that burn the way we do. Our convulsing, combusting, oxygen huffing cells. Fireflies light up in lust, blanketing

the countryside in sex-soaked glow. Brash males trapped in buckets. Females cast to earth below, embers molting in dark grass.

Lecture Notes on Proper Scientific Writing

“Use meaningful words.”

“Be concise.”

“Every word in every sentence should mean something.”

“Pick the best way, and just do it once.”

“Remember, you want to minimize non-data ink.”

“Let the figures do the talking.”

“No pie charts.”

“Picture the reader as a little kid, and lead them through.”

“You should be able to explain to your average taxpayer why it matters to them.”

“Give them a good story and they’ll fund your research.”

“The discussion is the hardest part, because you have to be original.”

“Use literature to back up any speculations.”

“You can cite yourself. Credit ‘personal observation.’”

“Use words like: ‘it may be...’”

“Look broad and make broad comparisons.”

“Always end with a paragraph about broader significance.”

“Sometimes we kind of lose that purpose.”

Methods

Niche

Jim is learning the Latin names of the trees. He knows how to identify them by the ridges in their bark, the thickness of their acorn tops, the teeth fringing their leaves. He wants to better understand the neighborhood by running a census of its residents.

He tells me most understory trees grow their branches straight out, flat, like big leafy pancakes. This way they can capture the most sunlight available in their shady domain. Canopy trees grow their branches up, like inverted umbrellas, reaching for the sun and a clear path to the sky.

Trees are, in this way, resigned to their stations.

No, hierarchy is the wrong way of looking at it. Trees simply know where in space to unfurl themselves, like birds born in midair instinctively taking flight.

* * *

Emerald Ash Borer beetles, little green oil slicks accidentally imported from Asia, are annihilating ash tree populations across Michigan. They have no natural predators here. The larvae drill their way through bark and feed on the tree's conductive tissue, its blood vessels. Without this tissue, nutrients and water sit heavy in bulging roots and the tree slowly starves.

The tree needs to be a certain size, meaty enough, for the beetle to burrow in. The vast ashes in the canopy, filling their environmental niches, reaching the sky, are eaten alive and die after a year or two, their insides carved up with patterns like ancient hieroglyphs.

But the young ash saplings, still in the understory, are too small to be beetle-prey. The species may survive like this. The ash may become, unwittingly, an understory tree. Young leaves leaping up towards a heaven they'll never meet.

Seeds

While others toil to remove it, Will and Brian carefully sow aggressive invasive spotted knapweed. They're interested in studying how it spreads. What percentage of their ruinous seedlings will survive in a healthy prairie? A "disturbed" prairie with half the other plants torn out? They will compare squares of earth and search for patterns.

This involves ripping out healthy plants. Will says before the experiment began they randomly selected plants to pull from plots with a random number generator. Randomness in experimental design helps control for unavoidable human bias.

Truly random numbers are hard to come by. Algorithms can create long runs of numbers that seem random, but eventually the sequence repeats, looping back on itself like an ouroboros. The starting point is a fixed number called a seed. What grows from this seed is a distinct human creation, a meandering mathematical vine.

Will and Brian use a different method. Their generator measures the background radiation scattered throughout the cosmos, a source of truly random natural entropy. They call down this chaos from the sky, harvesting it in the name of good science.

Will mentions one plot where, by chance alone, every plant chosen for pre-experiment-extermination was native, leaving invasive plants to flourish in their small pink-flagged square of earth. It was really the universe's fault, he says, laughing. He bends to retrieve a fallen pink flag, chewed to bits by hungry grasshoppers. Bellies packed with neon plastic.

Meanwhile, Brian clips the seeds off every grass and shrub in the plot, collecting them in little yellow envelopes. Later he will dry and weigh them. Another control, his handful of scrambled seeds.

Competition

Abe and Jack are pinning bees. They collect them with nets and fluorescent bowls filled with soapy water. Bees, attracted to the bright colors, fly down for a sip and drown. About thirty winged beings line the collection box: a fluffy handful of large yellow bees, two or three with shimmery green shells, and a swarm of smaller bee-like mimic flies.

I ask them what the story is. If I write a poem about your study, what should it be? It's about competition, Abe says, but you can't sum it up in one pithy statement.

The honeybees that we know and love are actually European immigrants, brought here around 400 years ago. On arrival, they quickly took advantage of the new world of opportunity. It's tempting to make the obvious analogy – a European species, stealing territory from natives? But honeybees live without human conscience. They'll do what they do. People brought them here.

Native species are still responsible for pollinating many native plants, including cherries, blueberries, cranberries. They may be more plentiful, too, and better at moving pollen than the nectar-hungry honeybee.

The public narrative is colony collapse disorder: honeybees are dying. Abe and Jack hypothesize that in their absence, more native queens could regain their thrones.

I ask them if they feel guilty when killing, and Jack gives a prompt *no*. Abe hesitates, and gestures to the largest pinned bee, wings frozen in mock flight. He's accidentally kidnapped a queen.

Prints

Stephanie is fingerprinting raccoons. Not forcefully. There's no line of guilty raccoons pressing their paws to ink pads. No drugged bandits slumped over chairs, hanging like striped mufflers.

Instead she assembles white boxes, dusting their bottoms with metallic black powder and paving a sticky paper walkway to the prize, an open can of cat food. The lured raccoon gets a free (if suspicious) meal in this little cubicle.

The prints resemble the handprints of human babies. Claw marks don't always show.

Steph says instead of ridges on their paw pads, like we have, raccoons have tiny bumps in various arrangements. Every raccoon has a different pattern, like minuscule stars making up unique constellations. She can use this information to track where in the forest the raccoons live and roughly how many are out there.

On walks I often spot the neon pink ribbons she's tied to trees to mark traps. When I see one, I know there's a telltale white box hidden somewhere back in the woods, even if I can't see it from the trail.

I see blue flags, too, left by some other researcher for some unknown purpose. And yellow flags, mysterious red flags, bright as fox-fur, creatures signaling their own hidden traps. Trawling for tracks, plotting muddy star maps.

Guards

The Karner blue caterpillar grows up with bodyguards. It secretes honeydew and pheromones, attracting hungry ants that feed and then tend to the caterpillar, protecting it from predacious seven-spotted ladybugs and paper wasps.

Anup is studying the association between different ant species and the endangered Karner blue. But first she has to find the butterflies.

One search-site is Fort Custer, an active military training center. Bullets and bombs fly among wildlife. Armed with only a net, Anup is afraid of being in the wrong place at the wrong time.

She's not ready to be martyred for science.

But she does think the search is worth it, despite the risk. She believes if she can show proof of an endangered species on the property, she can keep the land protected. The Karner blue not simply a research interest, but a silvery-sapphire guardian angel.

Anup has yet to find a single blue butterfly at Fort Custer. All the right plants and ants are present, but for some unknown reason the butterfly avoids the foreboding zone, leaving armies of ants to defend their own lonely hills.

Gossamer World

Cassie is painting protists: simple, incredibly intricate single-celled creatures found almost anywhere with a little water.

She collects pond water in little glass bottles, leaving lids ajar to allow oxygen in.

Protists, like many of us, need to breathe.

Diatoms like living snowflakes drift around green-tongued paramecia in a sea of butterfly scales. She thinks one looks like an eyeball, or maybe a bomb. She nicknames it “bomb-ball.” She’s worried people won’t believe the unfamiliar forms snaking through her art really exist.

The water itself looks scummy and lifeless, all stringy green chunks and silty mud. It’s always a surprise to slip a prepared slide under the microscope and find a hundred speedy beings munching forests of algae, spinning in circles like flicked coins. They navigate their environment by feeling around with sticky pseudopodia or cilia, like a human patting the wall in search of a light switch in the middle of the night.

Cassie watches one engulf another. She thinks of lions hunting on the savannah. But there’s no blood and guts, just two gossamer bodies becoming one.

Snake-sense

Jeff and Nate are hunting Eastern Massasauga Rattlesnakes. The species is threatened or endangered everywhere except Michigan. The official project objective: estimate total population size. But really they just want to chase snakes. Lugging buckets, tongs, and pillowcases, they slog through bog heat, forests of poison sumac, skyscraper reeds. The only clouds are made of flies.

I wonder what it will feel like to spot my first snake, curled into a fist and faintly hissing. I wonder if I'll panic, if there's a snake reflex coiled like a spring sleeping in my body.

Nate tells me he felt a grave anxiety *before* spotting any snakes. He worried he wasn't able to see them – that he had snake blindness, like a kind of obscure color blindness. He scoured the grasses for a week to no avail. And then, avail, a fat snake loafing in plain sight.

After that, he says, it was easy. He sees them everywhere. He finds two on the day I go out with them, long as my arm. Snakes writhing in tongs, sensing our body heat with a secret organ tucked between their eyes and nostrils.

I don't stumble across any snakes that day.

But I do see something else: a lone pine sapling in the middle of the swamp, drowning in a cacophony of grasses. Far from any suitable habitat, unequipped to survive, as suitable as an octopus in the desert. Yet defiantly alive. Needles sucking sunlight, each lime-colored pin made vibrant by some strange power.

The sight of the slight sagging tree, wholly unexpected, makes my heart shudder.

Burns

Sara selects lethal-looking clippers with red handles and a three-foot wingspan. I settle on a rusty handsaw. Our mission: cut down young trees.

It may seem like an odd task in a nature preserve, but this is what maintaining a nice ecosystem takes. We're clearing trees out of the "prairie" area, where they, by definition, don't belong. It's for good reason: many bird species need big open grassland habitats to survive.

Hated invasive trees like Autumn Olive die at our hand, along with beloved elms and oaks.

* * *

One facet of keeping a prairie a prairie is the controlled burn. Fire is intimately intertwined with prairie life, incinerating the woody, weedy plants we've been hunting. Some seeds only germinate after exposure to flame.

Through all this management Pierce Cedar Creek hopes to restore former farmland into something "more natural." "More natural" often means something historical, what a landscape was before settlers came and cleared it. But how far back to look for the "correct" land genre is contentious – Native Americans were setting controlled burns for hunting purposes, long before Europeans barged in.

According to Sara, one clue to an area's historical tree species is the composition of old barns. Humans don't like to haul heavy lumber, and wouldn't build far from a wood-source.

Her husband's job is to tear down these timeworn barns. He's a former barn builder, but his philosophy changed along with the nature of his work. He's learned to find value in the tearing down, fashioning furniture from the old wood and warmth from miniature controlled burns in his furnace.

* * *

(Sara would like to remind the reader that at one point, Michigan was likely covered by glaciers. Perhaps the most authentic pre-human landscape would be miles of unbroken ice)

* * *

Sara says she personally wouldn't mind letting this prairie grow up into a forest, its natural successor. I picture cool shade and a soft moss carpet. The cut sapling in my hand serving as an impromptu parasol could have been a grandmother.

But for the rest of the afternoon we labor to keep the land static, a singular human thought born of flame, patches of pesticide, panting handsaws. A new construction from the old. Nostalgia and ashes.

Results

Science Night at the Putnam District Library

They come in with big boxes full of zebra skins and snake sheddings
long as my body and raccoon dog furs, softer than my own dog at home.
I want to bury my face in it, but it smells funny, like my grandmother's

frayed couch, splattered in old lady rose-print and mouth-colored wine
stains and a yellow spot on the arm where I once spilled
the fish bowl by accident. I was trying to lift it onto my lap

so I could get a better look at the goldfish's little mouth as it babbled,
looking so much like the way my grandmother's lips pucker
when she's chewing on a secret.

They tell us a familiar story, the one about a beautiful future world
where everything is coated in silver, and mysteries
are solved by blond men in rubber boots slurping DNA

from cornstalks, and lions and elephants roam North America
again, like they did before we showed up and ate them all.
I think about how everything kind of turns silver already

when it rains, but I don't say anything, not even when the kind-eyed
woman looks right at me, wanting to purge me of questions.
I just hide my face in my sister's leopard print shoulder

and try to look younger than I am. They teach us about bees:
how bees eat nectar and wasps eat meat. You can tell them apart
by their hair. Bees are fuzzy, but wasps are sleek and smooth

as automobiles. They tell us when a queen bee gets old,
the bees can smell the oldness on her. They circle her and beat
their wings so fast it gets hot, hot as a star, and she burns to death

right there, surrounded by the children who gave her their lives.
My life feels glossy like a wasp, but sometimes I'm a bee-ball,
ruining the things I love most at some secret signal, crushing them

in my center. They ask us for questions. Ben asks if they've ever tied
a string around a fly and watched it buzz around in circles like a helicopter
on a lasso until it pops its own head off, and they say no.

Ben asks them to please explain how any kind of creation is possible
without a God, and they say that's not an appropriate question.
Ben asks what dirt tastes like, and they answer that one,

they say bacteria live in soil that make it smell soft
when it rains, make that cloud-dipped world taste so alive.
When they ask Ben his favorite science word he says “philanthropy.”

I don't say anything. I keep my questions swimming in me
like goldfish, and either I'm the bowl or the water
or I'm swimming, too.

Mechanistic (to the Grasshopper in my Kill Jar):

Tan and fuse-faced, breathing through spiracles
in your abdomen and thorax air laced
with poison I prepared precisely for this purpose,
it seems you know you are dying.

Maybe this moment, grasshopper, is a pebble rattling
in some heavenly loafer. Things playing out, pulling
our collective legs. Look at how you're kicking,
two amber pistons punching my palm through glass.
The two of us clasped in God's holy finger trap.

In Newton's vision of a clockwork world
the universe is a music box wound at the moment
of conception, still tinkling weakly on,
the tune as uniform and repetitive and secret
as the dark matter scattered throughout the stars.

Johannes Kepler, elucidating the motion of celestial bodies,
declared he was thinking God's thoughts
after him.

For the scientist-prophet it's easy to forget
a grand mathematical theory of everything would be tax
forms to a frog, whale song to wisteria.

How many creatures think God's thoughts
before him? How many skim the glassy surface
like water striders?

According to my textbooks:

The cell is a factory. The body is a hospital.
The mind is a computer. The heart is a dugout
canoe. Hope is a stubborn wrinkle

in a freshly ironed shirt. It folds and folds
itself the way proteins fold, all alpha helices
and beta pleated sheets, folds into function.

Insects are tiny whirling helicopters, or unmanned
drones. They occupy their bodies like pilots

searching for lost parachutes.

The abducted grasshopper hopes to live. It vomits
void-black bitter liquid, a defense mechanism
to will away the gas, as if I were a field mouse chewing it up.

The sticky stomach contents are all over the jar, golden in the sun.
The liquid seems to be a rhetorical question.
Quirky and quiescent as a dog nose, nudging.

Pinning Advice:

- Leave bodies in the freezer at least 3 hours (if removed too soon the insects will thaw and wake on the pin, screaming).
- Push the pin through the right side of the thorax (it will make a faint crunching sound that will either feel satisfying or sickening, depending on your personality and state of mind).
- Arrange body parts into the desired positions (many insects curl up in fetal balls as they die, and need to be pried open like locked diaries).
- Legs and antennae and other bits may snap off unexpectedly (beetles are notoriously fragile-limbed, despite their diamond-flecked exteriors).
- Never touch a butterfly wing directly. Its scales will rub off, revealing the naked membrane beneath (the dust will coat your fingers like an exploded dye pack in a bag of stolen cash).
- Wait at least a week for bodies to harden (after drying they will be untouchable, crumble into dust at a single thoughtless thumb-slip).
- Maneuver your own limbs carefully (keep your brittle body sky-bound or burrowed, blistering and ticklish. Never climb on a pin out of curiosity, or love).

Atoms

Flies orbit my head like a sun. Tiny humming planets, miniature black moons.

It seems a miracle the flies don't collide and spin off in ten directions like a NASCAR crash. Their dance made all the more complicated by myriad limbs and wings seizing the afternoon breeze. Hyperbola, parabola, ellipse.

Minute fruit flies are especially infatuated with my eyes. One dips its proboscis in my iris like it's checking the temperature of bathwater. Meanwhile, the steaming buffet of my broiled forehead beckons.

Flies ricochet off my head with the faraway sound of the thousand meteors raining down on earth's atmosphere every second. The fly in my eye feels liquid, a drop of honey. Its legs falling off and blinked away seem like thoughts shed, the indiscriminate black bits of life uncommitted to memory.

In a desperate attempt to throw the flies off track and away from my face, I swing my arms wildly. I make no contact, just flail for a second on the empty trail. I thrash until I feel the crack of a fly body on the back of my hand. I feel like I've hit a home run.

I recall spotting a friend perform the same strange full-body shudder in the distance, and at the time assuming she was waving. I waved back, in her general direction. She kept on waving. So I kept waving too. And we waved and waved and waved.

The flies follow me home.

Once inside I notice weak flies clinging to dimly lit door windows. They don't seem to understand what glass is. I pick one up by its wings and it vibrates feebly in my palm. I open the door and it veers crookedly into the evening. Wild as any housefly, gravity-suckled as any moon.

In 1910 Jean Perrin suggested atoms were structured like tiny solar systems. The fiery nuclei, the negative particles revolving, dizzying mystery corpuscles. Peering up like peeling back the apple skin of the world.

Hantaro Nagaoka proposed atoms as mini-Saturns. Electrons the beautiful pastel rings looped around a positively charged body, spinning stable and eternal. The universe synonymous with earthly matters.

A different model: plum pudding, the fabric of the world a pleasant dessert, studded with electrons like raisins. Smelling of suet and Sunday mornings. The positive charge spread evenly like butter on bread.

Geiger and Marsden tested the plum pudding model by firing a beam of alpha particles at thin gold foil. Startlingly, most passed through the foil as if it wasn't there at all – revealing matter is almost entirely empty space.

But one in every 20,000 particles deflected 90° or more. This particle recoiled off one of the large positively charged nuclei in the gold atoms, its central sun. An event as unlikely as a laser pointed at the sky striking the dense core of a star.

Ernest Rutherford said: “It was almost as incredible as if you fired a 15-inch shell at a piece of tissue paper and it came back and hit you.”

Now the idea of atom as tiny solar system is old-fashioned. Electrons are not distinct planetoid particles in orbit, but wave-like, a hovering cloud of negativity.

It's impossible to know for sure where the electrons are within the clouds we assign them. Everything made of maybe. The new atomic model a map of an alien world we've never seen and can only prod with crooked mathematical fingers.

Buzzing on the door latch, our old-fashioned housefly hunger.

Mauve

I go out with a migraine and a net to the humid after-storm forest with its whole tree limbs lying in the path jagged ended as my mind, its stumps and ripe black raspberries I devour like medicine. I'm greedy. I take everything

I can get. Thousands of exploded dollars in the form of patriotic smoke sucked up my nostrils. It will condense into storms that rain gold sparks. Tonight lightning bugs will fly up in frenzy, will bathe in sky-fire. The raspberry plant claws a fist-sized hole in the net

and my fingers dripping berry-juice dye the hole red. Mauve-stained fingers, mauve the color an eighteen year old chemistry student accidentally created in the lab in 1856, trying to make an artificial quinine to save British soldiers dying of malaria in India.

Instead of medicine, he invented a color. It became all the rage in France and London, mauve ribbons and bustles and cage crinolines, in the words of Charles Dickens, "all flying countryward, like so many migrating birds of purple paradise."

I read we collectively remember the color as lighter than the deep dark original dye, the color that couldn't treat malaria but could captivate, make captive, make that former chemist millions. I pounce on a butterfly with wings fringed like maple leaves bloody

and Canadian, like vowels oozing and awing out of north-wind whipped lips. The turkey vulture above eyes the fluttering net like a carcass. I put the butterfly in a jar. I put the jar in a freezer. I put the freezer in a U-Haul truck painted with facts

about Louisiana and about butterflies: "Unexpected treasures unfold in the unique terrain of southwest Louisiana. Rare land formations, found only four places in the world, are home to millions of migrating butterflies."

I feel like the unmentioned three places, like an unmentionable land formation squirming with butterflies. Unexpected treasures? Sharp and achy, the blue ceramic bowl of my brain shaken off the top of the fridge.

I want to catch a tiger moth; I want to be the tiger moth I catch. I want to be the catch itself, the Canadian carcass, the cage crinolines. A U-Haul with a single frozen butterfly inside migrating north on an All-American Road.

Meadow Lodge

Maybe I'm foolish for trying to write on the weatherman-
proclaimed hottest day of the year, a windy one
that jerks my skirts up over the wicker chair, lifts cottony seeds
straight up to heaven. The mowed grasses sit wrapped
as giant green haystacks, dotting the field like dead-eyed cows.
It's easy to imagine pushing them down a tall hill,
the way they'd roll and roll forever.

I prefer to envision the smug weathermen, sitting indoors
in leather chairs, keeping track with their Blackberries
as the temperature flies past 90, cackling black-jacketed prophets.
Or maybe outdoors, picnicking with their two young children
and the neighbors. Snacking on fresh cherries
and snatching finger-stinging baseballs from the sun's oily grasp.

Mourning doves never fail to elicit emotion. The lilac bruise
of their calls, spinning and spinning like velvet dough-rollers,
always far-flung and falling. A rabbit died next to the road
yesterday, its cry sounding nothing like a mourning dove.
Some student researchers, responding to the call,
examined it from Meadow Lodge with binoculars.
Watched it drag its broken body to nowhere.

A dragonfly the length of my foot hurtles by like a missile.
I'd give anything (well, not anything).
But I'd give the crisp two-dollar bill collecting dust on my chest
of drawers, the two-dollar bill I'm saving especially
for deals with ridiculous devils) to catch it. I would push a pin
between its top two wings and anchor it to the earth
like the beautiful jeweled sky-ship
it is. I would scrape the beige eggs from its abdomen
and fry them in butter. I would curl them under my tongue,
write about their mothy mourning-cry taste.

Field Trip

The needlework June day, fringed with storm like lace,
and the class descending from their brusque bus ride.
Freshly spit polaroid pictures, shaking themselves
and each other, materializing in a fuzzy world
of their own chattering creation.

One has taken me by the hand. Amanda. Plump with a bob
and a bottle filled with shaken insect. What is it? I don't know
so I tell her to give it a name. She seems vaguely unsatisfied
with this, as with everything I say, like I'm a Magic 8 Ball
and I keep coming up *maybe*.

Another girl takes a single bite of an apple and throws it away.
The thump of the fruit in the empty black bag sounds like a timpani
played so enthusiastically it bursts open. But she's just bored with fruit
and hungry for something new. I don't like apples, she says.
Which she surely knew before the bite? Or maybe she's so young
she still has to pass judgments like this hundreds of times a day,
the world an apple to bite and discard, or tuck back in the brown bag
along with cherry-flavored Kool-Aid and note from dad.

I wonder how many of these children will be scientists someday.
How many will decide they like the taste of smoke exorcised
from deep fried prairie, the smooth white cream nestled
in the heart of the mushroom like a Cadbury egg?
The tender black muscle of a snake held aloft
while measured, tagged, and released
back into its paper bag world?

Specimen Collection

I think of trapping a Baltimore Checkerspot
and mailing you its bright wings.
Speckled orange and black,
lapping at the wind like cat tongues,
alighting on tall grass the way laughter lands
in the base of the throat.

One staggers through space
and falls into my open palm.
It licks the sweat pooled there.
This tickles in the way a mosquito
kiss might, if tamed and made bloodless.
It sashays away on the wind.

If I had caught it, I would have killed it
without hesitation.

The force that held my hand back
is what I really want to mail you.
Colorless and still as it is.
We pin it carefully
to our own bodies.

Discussion

Land as woman

reclining on the molten core. Nurturing life-giver, mysterious Mother Nature, curvature of the Earth. She's pure and pristine or she's used, disturbed, a crater in the crust. Nobody ever makes love to the land. She's raped, stripped naked,

fucked. Is it sexual to plant rows of crops like scars along her abdomen? Is she still a virgin if you pluck out her orchids? If you slaughter her wolves? If you etch trails through her center and enter her, hike up her skirts, invite

the public to shelter in tents along her picturesque shorelines? She cycles like a woman: the menstrual moon phasing, the monsoon seasons, the rose hips ripening in the musky womb of autumn. Yet you can buy her.

You can have her how you want her. You can dismiss her afterwards as ruined. Some land is baptized barren. Some women blow kisses through bared teeth. She's still cradling bones in graves, she's harboring families of herons.

The military is dropping bombs in the Nevada desert. Activists are decrying foreign farmland as tainted while fetishizing chaste rainforest. In reality, the rainforest has been altered by humans for thousands of years. It's full

of fruit trees, a big overgrown garden. And so. Eden as mistress? Mother? Shameful daughter? Virginal bride? Ownable? Unknowable dark side? Soul?

Tree of Life

"As buds give rise by growth to fresh buds, and these, if vigorous, branch out and overtop on all sides many a feebler branch, so by generation I believe it has been with the great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever-branching and beautiful ramifications."

—Charles Darwin, *On the Origin of Species*

A bat the size of a blackberry. A flower that smells like a corpse and blooms five days a year. A nematode that spends its life in the lungs of one particular lizard, measuring its life by the rhythmic expansion and contraction of its ribs.

We can list 1.3 million species. Yet 90% of the creatures on Earth go about their lives unnoticed, hidden within lungs and under couch cushions. Most too small to see. Each producing something sweet in secret.

Species are going extinct before we can name them. The library is burning and here we are, counting books. Or maybe the forest is burning, and we are all Smokey the Bear, shaking our furry-hatted heads and pointing fingers at campers we've never met. Recycle! Only you can save the planet.

On the phylogenetic tree our species is a single cell in a single leaf. The canopy is the Milky Way. The roots are said to curl around the water-monsters of the underworld. Scientists have found that fungi connect the roots of forest trees, transferring nutrients between them. They flow as knowledge does, source to sink.

The trunk is mossy. The dank bark seethes with life. Just because something is silent doesn't mean it's asleep. Inside, nutrients swirl in cells. Some distilled from air. Some slowly broken out of rock-bodies. As water evaporates from leaves, it literally pulls chains of water molecules up through the xylem of a tree. Gallons of water fly skyward like this every day.

Try to name the thing tugging at the pores in your palms, pulling rivers out of your body a molecule at a time. Follow the tendrils to the squirrel nest, to the pulsing ribcage of branches, to the tangled bank. Nap in the ramifications. Allow yourself to grieve. Emotion is, after all, a form of sap.

All those blackened branches, with human fingerprints embedded in the ashes. If you rub your eyes, they'll burn too. If you want to axe the metaphor, you'll have to come in contact with the trunk.

Feeding practices (the reasons we eat each other):

For lepidophagy.

For helpless apoptosis.

For fearing monophagy.

For inevitable entomophagy.

For paedophagy, a form of osteophagy. etioloating.

For jubilant trophallaxis.

For sacred hematophagy.

Feeding practices: a glossary of terms

le·pi·doph·a·gy

noun

1. Fish stripping and eating the scales of other fish.
2. The satisfaction of scab-picking.

ap·op·to·sis

noun

1. Also called “programmed cell death,” the cell dissolves its own body, which is then consumed by neighboring cells. This carves out fingers and toes.
2. Extreme sacrifice.

mo·noph·a·gous

adjective

1. Eating one kind of food exclusively.
2. Trapped in a foreign cell.
3. Living permanently alone.

en·to·moph·a·gy

noun

1. The eating of insects.
2. Overcoming a pathological fear of spiders. Putting them in their place.

pae·doph·a·gy

noun

1. The strategy of feeding primarily on the eggs or larvae of other animals.
2. Preying on children.

os·te·oph·a·gy

noun

1. Herbivores consuming bones for necessary nutrients.
2. Desperation.

eti·o·late

verb

1. To deprive a plant of sunlight.
2. To make pallid, sickly, bleached, elongated.
3. The act of weakening.

troph·al·lax·is

noun

1. The exchange of regurgitated food or fluids between insects in a colony, forming a “communal stomach.”
2. The act of vomiting for social-bonding purposes.

he·ma·toph·a·gy

noun

1. The practice of eating blood, sucking or lapping.
2. Blackmailing or extorting for money.
3. The instant wine turns to blood in the cup. The Mystery.

The Matthew Effect

“For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken even that which he hath.”

Matthew 25:29

No Nobel Prize for Nettie Stevens. Queen of irony, goddess of sex chromosomes. Discoverer of letters Y and X. She found the sex of any glistening infant was not determined by “embryonic conditions,” aka no specific sin performed by the mother could transmute a baby into a girl in the womb. Not eating too many sweet fruits, not enjoying herself in bed, not daring to work alongside male colleagues in a sterile room. Even yellow mealworms showed clear heredity. XX like kissing crosses, XY like boxer’s breath. Nettie’s breasts cost her her life. Death and then endless tortured remembrance on internet lists of forgotten female scientists. Who got snubbed the worst is up for debate, as if we could have a snub-off, replace first names with gender neutral initials and declare the issue snubbed out of existence. Nettie Maria who? N M Stevens. Did what?

Parabiosis in 10 Simple Steps

Materials Needed:

2 mice: 1 old, 1 young

20 mg anesthesia

1 razor

1 scalpel

1 silk suture

10 staples

1 mg blue dye

Procedure:

1. Open the cage door and insert your hand. The young mouse will relax and accept you as another mouse. It will come to trust the way you smell. The old mouse will seem to know what is about to happen. It may try to bite you. Reprimand it gently.
 2. Lift the mice firmly by the neck. Cradle them in your arms as you would a child.
 3. Inject the anesthesia into the right lower abdomen, avoiding internal organs. The instant of the jab, tell them you are doing this because you love them.
 4. Hold them until they fall asleep.
 5. Shave the mice: the old on its right side, the young on its left. Brush the white fur from your gloves and wait for the razor-buzz to evaporate from your memory.
 6. Slice the mice open, from the base of their spaghetti tails to their pink fingers. The flaps of skin should be as soft as an infant's earlobe.
 7. Line up the bodies so the red lips of the incisions kiss. This is where the two will become one. Do not allow your hands to shake.
 8. Sew together the knee joints with a single silk suture. Staple skin and muscle together so the union is irreversible.
- Note: Often the animals will awaken, panic, gnaw on the sutures, and bleed to death. Next time, try more staples.*
9. Test to ensure shared blood is flowing through the animals: inject one with blue dye, and draw the stain out of the other's body.
 10. Watch: the young mouse will age rapidly. Its body will furrow into the swirl of a question mark flipped on its side. But the old mouse, its memory and sense of smell will sharpen. It will sprout strange new bones. Its heart muscles will rise and fall with impossible strength, a ship that swiftly sinks, then wrests itself back to the surface, again and again.

Gaia

Your body is a planet. Ecosystems under every nail. Life breeding in the hair, the heat, the sweat, the spit, the salt, the heaving chest, the crease between your leg and groin,

the steep incline of mountain range veins embedded in your feet. More foreign DNA is replicating in your body than the DNA of your own genes. Hundreds of trillions

of bacteria renting skin space, eating your food, fueling your inner economy.

They serenade your brain. They make you feel hungry, tired, depressed. They keep you

alive. They stay awake while you dream. They engulf. They know you more intimately than you will ever know yourself. They accept your body as salvation, the truest

manifestation of the universe. They are condensing in the corners of your eyes.

They are sticking to your skin as you slide out of your mother. You will baptize

your children, too. You are a mosaic, the glittering glass tiles alive and infinitely shifting. You are exhaling them in the words you speak. You are shitting

them out. You are trading them with friends. You are more than meets the naked eye, the eye clothed in microscopes, the eye cloaked in skin.

Acknowledgements (Beings to Acknowledge)

Lumbricina (common earthworm)

I stepped on a worm on the sidewalk. It must be tough, invading
a kingdom of concrete and weeds when you're lowly bait

lacking face. A face is a city of dark meat and spittle seas. Eyes
and noses pour out bits of self and salt, drying

on skin like drops on a page. Once wrinkled, there's no smoothing
it out. I squirm, bent into the shape of the newly toothless.

Some faces are like educational health pamphlets: prophetic, boring,
only scary in the mourning. A face can be a warning,

a doorbell, an unraveling ball of yarn. I yearn for a place
where a face is just two dots and a line, the two dimensional space

romanticized by anatomy drawings. We're not so luminous
from far away. On the cellular level we're the same. Ruthless

and beautiful. I'm forgetting your shape: the diamond beads
of sweat I mistook for rain, the baggy nose sheathed

in a layer of antique wrapping paper, the candy apple residue
on the dimple over your lip. You're a slim ripple; you're under my shoe.

Echinodermata

This phylum contains six thousand species. The word Echinoderm means “spiny skin.” Echinoderms share many features:

1. A skeleton of interlocking plates (tessellated crystals of calcium carbonate, arranged into delicate glass beehives. Run your palm across the scobiform skeleton of a sea star to map the topography of the sea floor)
2. A water vascular system (hundreds of muscular tube feet, white and soft. By expanding and contracting feet in the right order the animal can slowly drag its body along the rocks. It uses these feet to smell, breathe, and eat)
3. Radial symmetry (limbs point outward from the center like the spokes of a snowflake, or the stars in the hearts of apples. Headless and brainless, nerves flood the arms, extending from the ring of the mouth. Body is simply a euphemism for mind)
4. Marine habitat (never knowing another world, to us their lives seem slow and their air heavy. Nocturnal, they live in our dark and we live in theirs. They never ask to see a sunrise. We never ask for the quiet concord of the eyeless)
5. Benthic (adults lick the sea floor, but the larvae are free-swimming. After finding a suitable spot on the seabed, the animal will undergo metamorphosis and settle down forever in its star-form. It feels a deep relief)

Tardigrada

No one knows where they're from. Soft bodies
don't fossilize. But they're perfect
at playing dead: can freeze and stop breathing, eating, needing
to move. In this state they can survive the vacuum
of space (the secret is to actually die,
then come back to life when no one expects it).

A pastor found them first, looking for God
under his fingernails. He named them
"little water bears," as Adam would have
back in the day, after the way they walk. Lumbering
like the clumsiest mammals, a potato sack
race. A raucous garbage disposal
mouth, eight clawed legs and the alien
gait. Created by accident on the eighth day,
when God gave the command to mutate.

Humans are hypocrites, exiling their fears
to the harshest places. They linger in the garden,
polishing their microscopes, flinging things
up into the dark. They never learn
to play dead, because they never have to.
No one ever ties them to the rocket.

The Two Anemones

Wind

Petals are overrated leaves, colored to entice
bees and hoverflies. I lack such dainty features.
Petal-less, sepals shield my most delicate center
bud. Yes, they look like petals. I am trying to trick you.

My name means “daughter of the wind.” You say Venus
created me by scattering nectar on her lover’s blood. I bloomed
in this sticky river, red in claw and toothed
leaves, a cocked pistol packed with grief

and seeds. But I am not Venus. I am not Adonis. I am not an ugly
soft-stinging anemone stuck in the sand. I am bitter. I am the Death
Flower, first to bruise the still-shivering land
with blossom. You would vomit

blood if you tried to dissolve my body in yours.
You are already choking.

Sea

The flower who shares my name would have you believe
I’m just a sessile slit face with a tentacle mane. That I have nothing
to teach. That I sit secreting mucus, paralyzing
the young and the weak at the bottom of the sea.

But listen: alone among animals I remember life
as a plant. Your body has forgotten,
but mine can’t. When my cells divide they cleave
like flesh and also like weeds, like the ancient

in-between. There is no kingdom for me
to inherit, no Animalia or Plantae.
To a damselfish I’m a forest, to a shrimp
the muscular tongue of a tiger, fur-lipped

and lecherous. We share DNA: my body in yours,
your body in mine. You are already budding.

Bdelloid rotifers

can only be identified when alive, by watching them dance.
Their corpses collapse into
unidentifiable balls.

survive by devouring foreign DNA. They're stitched together
from five hundred different species, including alien
bacteria and plants.

dry out their bodies to become inedible. Floating away
on the wind, they can live for nine years in this
dust-particle state.

haven't had sex in eighty million years. Entirely female,
they undergo parthogenesis, virgin birth, hatching
identical daughters.

can be summoned by soaking the bark of a young locust tree in spring
water. Legions of scientists are searching fruitlessly
for males.

Dictyostelium purpureum (as metaphor for family)

In boom-times amoebas are independent.
Swarming in soil, they stuff themselves with bacteria
and birth identical clone-progeny.
But as soon as a recession hits and food is scarce,
thousands of individuals give up
their freedom. They amass in one shifting, wriggling commune-
being, known as a slug.

The starving slug drags itself along the earth in search of relief.

When it finds a promising spot, the slug transforms again: not caterpillar
becoming butterfly, but liquid hunger transmuting into pure purple
want. It grows into a fruiting body with spores and stalk,
resembling a mushroom. Ready to seed a new generation,
dreaming of a better life for its children.

Only the amoebas at the top will live to see the new world.
Those making up the stalk are doomed.

Amoebas won't sacrifice their lives like this
for just anyone: they prefer to make slugs with their own
genetic clones over strangers. The compulsion to join
more primal than love, more raw. Wringing itself like an animal
shaking its own lone hand, or snapping its own neck.

Even slime molds recognize the self
outside the self, the dreamy awareness
that gives the world its inscrutable nostalgia.

Cymothoa exigua (amputation)

They crowd into the mucky cubicles of red
snapper gills. Born male, lucky
ones know how to grow into girls.

Newly forged females can spot the gaps
between gills. They steal into fish jowls,
where their eyes crumble into dust.
They no longer need to see.

The transformation has left them starving. And there,
a fat morsel of meat, bloody, twitching, defenseless.
They suck blood from the base of the tongue
until it shrivels away and falls off.

After this meal they attach their bodies to the stubs
and become prosthetic fish tongues.
The fish cannot tell the difference.

Here they spend the rest of their lives,
wrapping and unwrapping around slick squid,
licking the gums of strangers.

Tetrapus americanus (obligate mutualism)

She's born in the dark embrace of an unripe fig, purple and pulpy. She grows from grub to carapaced queen in weeks spent gnawing the walls of her nursery. Her brother is born wanting to mate with her. He does, while she's still curled up asleep, swaddled in eggshell.

He doesn't have her elegant stained-glass wings, or her funeral-black gem of a body. He doesn't even have eyes, just stained yellow teeth. She feels sorry for him.

She watches him drive his head again and again against the pink nightmare walls of their childhood bedroom. He tunnels, soft body squirming like a maggot. The fruit skin snaps and he feels sunlight for the first and last time. He can't fly. There's no other world for him.

Her eyes fill with the light and she walks to it, stumbling through a forest of fig anthers. Particles of golden dust stick like stars to the dark sky of her body. She is no longer than an eyelash. Stepping carefully over her brother's corpse, she unfurls her wings and leaps into the wind.

She flies free for five miles over shapeless boulders before encountering something familiar: the faint scent of her already-forgotten childhood. She follows it, sweet and sad. Drunk with expectancy, she senses the source: a perfect green orb hanging in the sky. Holy, meant for her. She understands rapture is only moments away.

Alighting on the fig, she gazes across its thick bumpy skin, stretching forever. There is no way in. But she must enter, the center is where the miracle will happen, she knows. She knows she has no choice. She crawls up and down the tiny planet in a frenzy, infatuated, willing entrance with every cell in her body.

Maybe it will split down the center, open for her. Doesn't it know her? Hasn't it been waiting for her, too? There's no brother to bludgeon a tunnel. Her sisters are on identical orbs, having identical feelings, but she has no way of knowing this. If she could she would weep. If she could sleep she would dream only of this moment, the apparition of this sphere, this feeling neatly tucked away in her chromosomes before she was formed.

There. She sees a small hole she had overlooked. She must enter. She has no choice. She inserts her head. The feeling is overwhelming, suffocating, irresistible. The hole is too small. She squeezes her body through anyway, writhing. Her wings stick at the entrance, too bulky, still hot from flight. There's no stopping. She's so close to divinity, to the ancient angel waiting in the center.

The friction of the narrow channel tears her wings from her body. Her antennae snag, too, and rip away, two matchsticks burning identical holes in the top of her head. Her limbs lithic and tangled, she falls limp into the center.

Pollen from her birthplace shakes free from her legs and scatters over the female fig flowers in the center, fertilizing them. The fig did notice her, the instant she entered. It has been waiting for her, but she has no way of knowing this. It begins to digest her body.

She lays her eggs in the fig ovaries and feels much lighter, like she could maybe even fly again, burst into the open air like a starling. The sticky-sweet smell means nothing to her now. She remembers the way the breeze tickled her feet. She forgets she is wingless. She flutters her wing-stumps.

I dreamed I was a fig wasp

Waiting in line for a burrito bowl. I try to make casual small talk about weather, but an insectoid clicking radiates from my beak. Everybody screams.

Bowling with my dad. He throws a gutter ball on purpose because he loves me and wants to let me win. I can't hold a ball because none of my six legs have fingers.

Fucking my high school boyfriend. I burrow into his body like a ripe fruit. The sharp teeth on my legs fracture his tibia. He just says to hurry, his dad is opening

the basement door. Crawling through a tube maze like the ones in McDonalds. The other kids are jealous of my wings. I'm terrified they'll tear them off

with their sticky fingers. I hide in the ball pit. Eating a ripe fig. Inside I find tiny versions of myself, squirming under my iridescent gaze. I cup them and set them

gently outside, as I do with house-spiders. They scuttle away. Taking a selfie. I keep dropping the phone and accidentally snapping pictures of a million-mile January sky.

Only then do I remember I can fly.

Brachiopoda ghazal

We opened our mouths like praying hands cupping holy water. Our world shrank to this, a microcosm dripping through fingers, an oozing shower-world.

The meteor that killed the dinosaurs destroyed our families, too. Extinction nudges you into forgotten corners. Cradle a relic and remember it's a death-scoured world.

Our soft selves evolved to be smaller and smaller. Like atoms we are mostly empty space now, a whorl of colorless blood in a shell. Not much to devour, world.

The articulate have toothed hinges and simple muscles. The inarticulate are wiser, but toothless mumble, struggle to align their lips, stumble through a now-slurred world.

Remember cowering in dappled pools lapping at the sun's blood? Ferns and giant insects embraced us with a million spindly antennae. Lost frankincense-and-myrrh world.

Fossils show insides as well as outsides. We left fingerprints on the insides of our bodies so we could claim land through our buried dead. Call from a sweeter, slower world.

We are pottery oil-lamps, untouched by fire but hissing with the essence of the light-upon-light. Still glittering under an ocean-glass pane in an electric power world.

Novel Ecosystems

Anthropocene Slogans

Nature's back and hotter than ever before!

Novel Ecosystems! The latest shift in a dynamic earth's wacky antics!

For the most coverage available worldwide – over three quarters of the earth!

From the people that introduced you to horses, pigs, grapes, apples, garlic mustard, and more!

New engineered genes, same great natural flavor!

Now with Technosol! The human refuse-soil that refuses to settle for less!

Available at a strip mall near you! On the road on the way there! Right outside your house! Literally inside your own body!

Competition will go extinct!

con·san·guin·e·ous

Ovarian cancer runs in the family. Something runs
in everyone's family, some sticky fingerling to be dug
out with scalpels and stitched into anecdotes
about dead parents. Or handled carefully
like a concealed handgun, hot in its belly

band, brandished to defend the recluse
uncle. The one shaking in his mother's cat-pee
basement, drinking away a sleep-thirsty middle age.
Cancer doesn't run, not really. It squats
in every animal cell, licking its hindquarters.

Edmund the middle school biology teacher
believed deodorant caused cancer. Along with sleeping
in, eating out, white-out. His meaty aroma
steamed up the hallway, the sweet rot of a stranger.
Vengeful boys slathered his classroom doorknob with white-out,

leaving him sweating in the hall, one tentative finger on the whale-bone
knob. He died of a heart attack three years later,
pushing a cart down the juice aisle.
Female hydra get ovarian cancer, too. Little polyp bomb
bodies. Cells made to breed sometimes get a little too good

at breeding, hijack their own defenses so they never have to stop.
There's no cure for this tic, this painful masturbation.
Ask anyone. Ask your doctor. I too
am programmed to die. I too would sprout five hundred
heads, ten lead-laced legs, if only it could keep my body still.

Soon after the war

the change machine broke. Now it nibbles dollar bills, spits up
a gummy liquid that smells like oil and dyes fingers
gold. All the machines in the arcade are broken,
anyway. The air hockey table puckless, but still exhaling
arduously, a woman blowing smoke rings. It sighs
in the corner by the jukebox, which blasts Smash
Mouth's smash hit "Walkin' on the Sun" on repeat
at an immodest volume. Even the fluorescent lights flicker,
making the room seem submerged, giving it the ambiance
of a tide-pool. And it is crowded with lurid, whirring near-life;
the skee-ball scattling, rattling pinball thwacking
its paddles in search of its silver bearings,
the Police Trainer that no longer discriminates
between crooks and civilians, awarding points for simply firing
the big red game-tethered gun into crowds.
The claw in the crane twirls like an unhinged ballerina,
its filthy interior housing a family of mice. They abide
the claw. They tear up plush unicorns and sleep in the cheap
polyester filling, sneezing from the dust
bunny carpeting until their noses redden and burn.

Premiere Recreational Nature Area Vacation

Fires glower at nearly every site, despite the drizzle.
Smoke fouling the air allows the man to light up
a menthol guilt-free, which he does, sinking into his lawn
chair and listening for the faint crooning of Elvis
from the aged stereo in his RV. Christened "Intruder,"
his hunk of wheeled plastic is larger than any others around,
all the "Cardinals" and "Cougars" and "Wildwoods."
The man lives one half hour away, even with the construction on I-69.

There aren't many trees around, but there aren't many mosquitoes,
either, which seems a fair trade. Each site an evenly sized square,
sites stretching in every direction like neat lines of cocaine.
Grass grips the gravel like a teenager's lame attempt at sideburns.
Three kids on kid-bikes wobble by in the direction of mini-golf, its turf
bloated with rain and disfigured by wood-chip acne.
The man smokes and watches a woman in a striped sun-hat push
a stroller down the gutted road, baby rattling somewhere out of sight.

His fire pit is smoking, too. The man filled it with sweet smooth
slabs of cedar from the patio he tore up last week. He holds a bar
of it now, much cleaner than a crooked soggy ash log lopped
from a diseased tree. He likes deciding what to burn and what to carve
into crude spoons with an old whittling knife. He likes the smell
and taste of smoke, even though the habit left him
with the voice of a clunker struggling to start. He never uses the spoons,
which would probably lodge splinters deep in a careless tongue.

The man won't use the indoor swimming pool, or canoe
around the artificial lake with its two feeble fountains,
even though he considers himself an outdoorsman. In his youth
he hunted, shot his first deer at the age of fourteen.
A piebald buck, white with brown freckled face. He remembers
its blue eyes, its crooked spine, its underbite. The soft nubs
of its antlers, fuzzy as thought, trickling blood from a bullet-
nick. He remembers his surprise. He was expecting bloodless bone.

The last deer he encountered was one he hit with his truck. An ordinary doe
that hurdled back into darkness, shackled to a broken leg.
That deer doesn't haunt him like the first. Maybe because it got away,
maybe because it bled from expected places.
The man didn't come here to watch anything bleed,
he came to burn things among hundreds of other people
burning things. These people get it. The age in which
crowds envelop you like sweet clouds of smoke.

White Nose Syndrome

I'm 10, standing in a freshly mown field, flinging rocks at clouds of bats in the open air. They dive in unison, synchronized swimmers, each presuming they've found the largest, juiciest mosquito ever. I adore the way they loop and swirl at this twitch of my hand. I wave my arms like a manic conductor, like I'm summoning thousands of trumpets.

My parents are 20, playing tennis. They've just gotten engaged. It's dusky and their shadow-bodies wander the length of the court, but they keep playing. My mother lobs the ball hard. When it hits her racket it splats like a lurid cartoon tomato. Lurches, oddly heavy. In the center of the court, a dead bat, tiny furred fingers clutching the ball.

I'm 20, scanning the sky for stars. I spot Mars, cotton candy pink, peeking through tree leaves. Five airplanes smear buttery streaks over the western horizon. Something dark masks the moon for one wild second. It swings out of sight. Silence. The sky teems with cold light.

Wreath Poem

I wanted to write a poem like a wreath,
like the skin-scarring wedding ring
that joins our bodies to the earth.

A swamp is a wreath of dying cattails and fresh
footprints and puddles of frog-song.
The one-legged frog simply living. Its right
leg in the tissues of a heron, its nerves still singing
two-legged kicks. Its mother decomposing in the center
of a snake, becoming a soft nothingness.

A forest is a wreath of sunlight and shadow, honey-
colored deer flies and the dark flashes
of their mandibles. Deer flies sipping blood from a cross
shaped incision in a human scalp. An old deer fly
faltering in midair, falling out of the sky, striking
leaf-litter with the force of a sleeper's exhale.

Just yesterday I set a wreath adrift in my own body. I watched
the ring float over miles of black water, a speck of light snagging
the eye the way a bur grips the fur of a golden retriever.
My wreath is made of broken bottle glitter
in a parking lot, the unseen roots of a familiar tree,
a single humming nerve to lay on a grave.