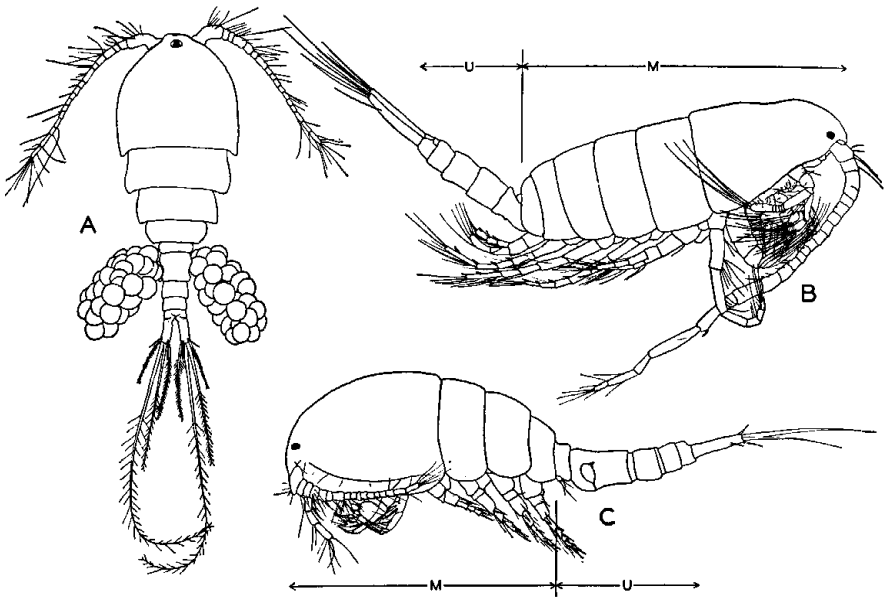
Quiet Creatures

A Summer on Long Island



by

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This thesis, entitled Quiet Creatures: A Summer on Long Island, *written by Neil Solon Banas, has been approved for the Department of Religious Studies.*

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The final copy of this thesis has been examined by the signators, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above-mentioned discipline.

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Quiet Creatures: A Summer on Long Island
Thesis directed by Associate Professor Lynn Ross-Bryant

I spent a summer working in a marine biology lab on the north shore of Long Island, padding along the local beach, watching the dramas of animal life there and searching for the keys that would make sense of them: the avenues along which I could enter the animal's home and feel myself at home. These desires—for a sense of logic and order in nature, and a sense of home and family—I see reflected in many other naturalists, from Gilbert White in the eighteenth century to Edwin Way Teale and Annie Dillard in our own.

The landscape I observed answered and rejected those desires simultaneously. The biological world is neither exactly logical nor a chaos; neither a ball of warm sentiments nor cold and aloof. It runs on other principles: a musky, tactless intimacy, and a meandering logic, full of reversals. We are absorbed within a complex organic system and fully dependent upon it, linked to millions of species, each with its own way of getting along, by a great web of family relationships.

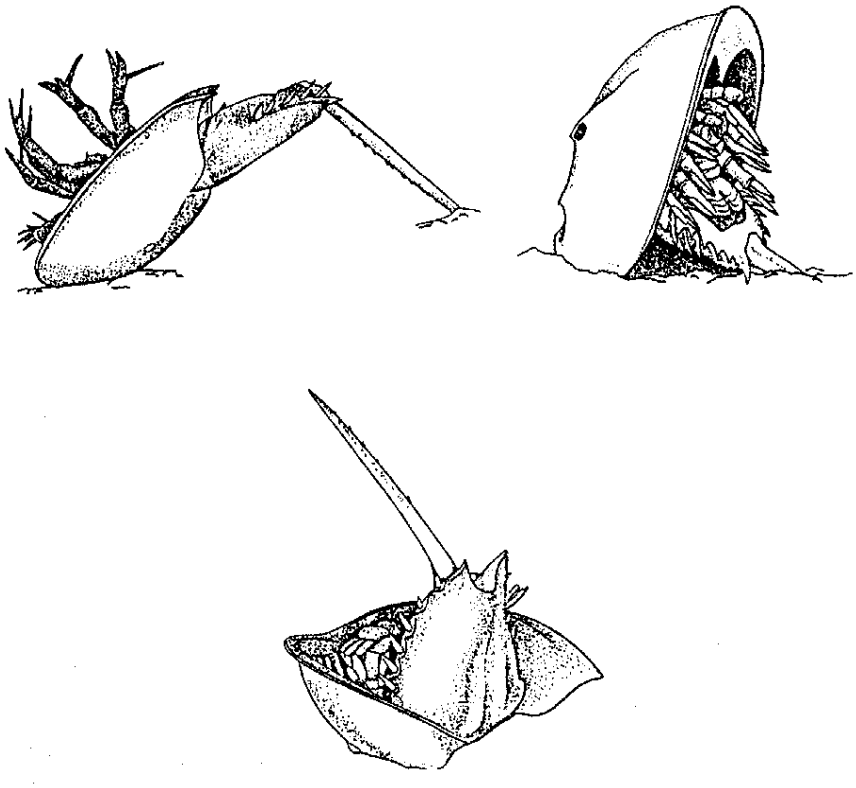
Intimacy in a landscape consists, for the most part, of digestion: gory and grotesque, but also smooth, balanced, and eternal, what Paul Shepard calls "a universal metabolism." Our human pursuits blend into this metabolism smoothly: the death of a creature under a microscope isn't so different from the death of a creature between a pair of jaws. When we ignore such congruencies, however, as our body-distaining culture

encourages us to, our inquisitiveness turns sour, and yields odd, unwholesome relationships. The alternative—so simple in the abstract—is to accept our full participation in animal life. We live within a great mystery: the mystery of bodies and their conjunctions, and, too, the mystery of how we, inquisitive and posturing, awestruck and cocky, rise from its midst.

I've written this as a personal essay, because these are personal issues, inextricable from my own desires and my own wrestling bouts with specific animals. I have tried to give a voice to the creatures I encountered on Long Island; I found that they had much to say, and sly and grave ways of saying it.

Contents

June



As many days as I spent at West Meadow Beach, the beach closest to Stony Brook, Long Island, where I lived and worked one summer, there was only one day on which I got to look at it from a vantage I'd call comfortable. It came early in the summer. An extreme low tide had exposed a sandbar a dozen yards offshore, and I waded out and sat down, looking back toward the pebbly beach and the parking lot beyond. The sun was bright and washed the color out of everything. The water was calm, as it always was here: West Meadow opens onto Long Island Sound, not the ocean, and I never saw a wave here more than six inches high.

A few terns wandered back and forth overhead, rather aimlessly, for terns. From the sandbar I could survey the whole span of the public beach. This wasn't such a feat: summer homes owned the sand to the left and right as far as one could see around the curving shoreline. You could walk the length of the public beach in five minutes, if for some reason you were in a hurry, or over a lifetime, if you were a sea snail. Once on this beach I watched many dozens of sea snails swarm over an intact, dead crab as wide as my outstretched hand. They were decomposing it in slow motion, building themselves from it. If I had stood still long enough, my feet could have become sea snails too.

But I was sitting on a sandbar now, and no snails were anywhere in sight, although I knew they must be somewhere nearby, at the fringe of my senses. Lots of things were. Clams siphoned smoothly, nestled into the sand everywhere underfoot; horseshoe crabs hung somewhere out in the

deeper water, waiting for evening to fall, when they would arrive and cluster up tightly against the shoreline. In every handful or mouthful of seawater lived a profusion of tinier forms, leading their own complicated lives: it was these creatures, the plankton, that I had taken my summer job in a university marine biology lab here to explore.

A hefty gull at the water's edge browsed among the smooth stones and kelp. It was joined by several grackles who must have flown in from nearby yards, working for their supper. I settled a little deeper into my seat on the sandbar. The humans on the shore—the children gathering stones, the parents sitting and looking about, unconcerned, with far-off eyes, like the gulls—seemed no closer to me and no farther than the other animals. Their umbrellas and chairs, the towel and backpack I had set down near the high-tide line, seemed like biological artifacts: bizarre but explainable, the same way a periwinkle shell being worn by a hermit crab is bizarre but explainable. A tinge of happy domesticity widened in me, a communal feeling, streaked by strangeness. I thought of Annie Dillard's account of her visit to the Galápagos Islands. She knelt in a barren lava field by a giant tortoise slick with algae: "I stared at the algae, and at the tortoise, the way you stare at any life on a lava flow, and thought: Well—here we all are."

I leaned back on my elbows. Yes, indeed, here we all were—the sand fleas bouncing off the sand, the huddled gull taking a break from browsing, the human in the chilly blue trunks—all a bit wet, a bit hungry, a bit rumpled. We sit on the sandbar and greet the newcomers.

When I returned to West Meadow a few days later, the sandbar was under two feet of water, and it remained underwater every time I returned. For the rest of the summer I strained after fragments of that communal sensation and caught a few, but only a few.

It's damnably hard to sit at rest and acknowledge simple things so simply: I'm an animal, a clam's an animal. I search after food and a sense of home, a sense of belonging, a sense of safety; young gulls search after food and whatever it is that makes them huddle up next to their mothers and peck at their beaks to be fed, and squawk when they grow older and get pushed away. Likewise, it's damnably easy to ignore such congruencies, or dismiss them as superficial, and live as if the only beings on earth who are like humans are other humans.

It isn't news to observe that modern societies are growing increasingly estranged from the natural world, that we're forgetting how to live as part of a larger network. Technology invites us to see living creatures as objects to shape to our needs, rather than as partners. Ever since Plato and Paul, a doctrine has been crawling about that says we don't really belong here in these animal bodies—that our souls were made for another place. But such things are only part of the story. Alongside the currents that make us aloof to the animals are others that send us to the opposite extreme: we yearn for contact and come on too strong. I'm thinking of zoos, poodles dressed in sweaters, and the day I barged in on a pair of mating horseshoe crabs.

It was my first visit to West Meadow, just a few days after I arrived in Stony Brook. Nothing had settled into routine yet: I was full of questions. I saw nothing around me but activity and conjunctions. For many of the plants and animals around town, this was the height of mating season; for others, it was the season immediately following, in which the little ones scatter and take over the world. If we were to set up a new calendar, based on things organic and substantive, June first would be a good choice for first day of the year.

I strode out onto the sand, alertly searching for interesting things, and my eyes latched onto a pair of empty horseshoe crab shells, one half-atop the other. As soon became clear, they were far from empty, and motionless only because they were rather involved in what they were doing; but it was an understandable mistake. I grew up a couple of hours from the Jersey shore, with just enough natural history knowledge to be dangerous. I didn't give horseshoe crabs much thought, though I knew what they were; subconsciously, I suppose, I concluded empirically that all horseshoe crabs were empty shells tossed up on the sand, large brown ones, just as sea snails were small spiral empty shells, rather than hungry creatures that forage on detritus and are related to giant squid.

Later in the summer I pieced together the story of the horseshoe crabs' mating. Up and down the Atlantic Coast, a tide of horseshoes rolls in at the end of the spring. Along Delaware Bay they arrive by the millions, and hide the beaches under their slow, rock-hard carapaces. They paddle, upside-down, 150 miles across the continental shelf for two

months to reach these calm shallows, the places where waves lap rather than roll. As they cluster a persistent male latches on to the back rim of a female's shell with his foreclaws, two pair grown specially for the occasion. Meanwhile his rivals hang by idly, often vainly latching on to him. Then, on a full-moon evening, the female drags her mate up into the intertidal sand and lays her gray-green eggs, and the male fertilizes them where they lie. Later in the season they'll travel the 150 miles back out, and spend the winter dug down into the sediments, letting storms and cold pass high above them.

But all I saw that day at West Meadow was a couple of shells. I was equipped with nothing but first impressions, and feeling rather solipsistic—the keen experimenter released into his laboratory, or rather, his playroom. I crouched, and jabbed the top shell to flip it over. It resisted: in fact, he squirmed, though less than I would have under similar circumstances, and his mate squirmed under him. My insides squirmed over them: I found myself apologizing sickly to animals that didn't speak English, and in fact didn't have any ears. I had been jerked out of my solipsism. The keen experimenter had been exposed as just one sensitive animal among other sensitive animals, one who had no more clue what was going on than they did.

Actually, that isn't true: after five seconds the horseshoes returned to their unabashed business, unperturbed. I was in fact much more confused about what had just happened than they were. They each had located a partner to lay eggs with and a beach to lay them on, and were

sturdy enough to shake off the occasional jabbing; I was still having trouble locating myself. Which raises an interesting question: what had I been hoping to find under an empty horseshoe crab shell in the first place?

Some facts about horseshoe crabs, certainly; but also something more. I suppose that when all the days spent on the beach and in the science library are summed, I was searching for some sort of home, trying to climb back on that sandbar, looking for the sense of self that will dispel this feeling of estrangement from the larger natural community. But I find there's no skipping steps in a venture like this: you don't figure out who you are by jumping to the punchline. I prefer to hook myself onto the back rim of science as it goes about its business and let it drag me along the sand. It's an awfully circuitous route to self-knowledge, but it has the virtue of leadenness: I maintain a gritty contact with the earth this way, with sharp facts.

It's a big world out there, and everyone in it has a story. That's why science gets mired for decades in what seem like the most arcane of details. Ask the littlest protozoan a simple question, like "how do you swim," and it chews your ear off for hours. But I feel obligated to listen. If you want to be part of the neighborhood, you have to take the time to meet the neighbors.

Horseshoe crabs tell good stories, and my respect and affection for them mount continually. They have repeated their migration 350 million summers in a row, since a time before dinosaurs were even an idea, let

alone extinct, a time when this coast of North America basked in tropics south of the equator. All their rituals proceed as if with an awareness of this eternity. A male sits atop a female like a stone and shifts his weight minutely, at intervals, like the seafloor creaking; they carve shallow paths in the surface of the sand, by imperceptible degrees, inexorably, like the continents continuing their own migrations.

They are eccentric animals, schematics of motile durability. They are, more precisely, inverted frying pans that occasionally wag their tails. A visitor most often sees them heaving themselves over the sand, or dead, and in these states they seem more contraption than creature: in fact, the two states are barely distinguishable. In the water, however, where they hide like shadows, fuller personalities unfold. "Horseshoe crabs scuttle," wrote one marine scientist, "and scuttling is the same as scampering." They're actually lively, it occurred to me with a start, the first time I saw them swimming by my ankles. They turn and they bobble; they jet forward and suddenly hunker down.

They test everything they pass over with pincers hidden underneath their round shells. They're searching for clams, worms, dead fish, anything edible. They seem much more suited to pincering than to analysis; during the mating season, for example, males will try to mate with anything in their path, rocks and toes alike, until it's been thoroughly established by feel that the something is not a female horseshoe crab.

They're lunks, but at the same time they carry with them—like

every wild animal I can think of—a specific, proprietary dignity. They live with perfect composure, as if after this length of time they've casually come to trust the landscape to shape itself to them. The longer I spend with them, the more I feel compelled to uphold that trust, never to betray it with violence or crassness. Their behavior, so completely contained, asks for the maintenance of a respectful distance—while also suggesting a kinship, an equivalence, between my activities and theirs.

Their dignity, and the separation between us that feels appropriate, derive in part from the fact that they're rather baffling, and I think would remain baffling no matter how many hours one spent with them, no matter how many books one read. They never quite settle into place: they remain riddled with contradictions, their behavior a long list of exceptions to rules. Everything living behaves this way, though there's something in the culture of science that denies it. Field guides and biology textbooks teach their students that nature is reliable, that it has agreed to make sense as a reward for the searcher's persistence—as if nature shook on this with Newton and Francis Bacon. In fact, I've noticed a tendency among scientists, myself included, to take any violation of this contract as a personal insult, as if nature were gleefully conking us on the head with peanuts while we were trying to get some work done.

I get conked, in fact, far more often than I get my hand shaken—at least when I'm paying attention to what's in front of me. There was one day at West Meadow when I stood waist-deep in the water, picked up a piece of floating kelp from the surface, and saw flames in it. We're talking

about kelp, seaweed, cold and slippery; and flames, deeply orange, smoky like a sunset at the end of time, forked and ephemeral as lightning. The water was throwing shards of sunlight in my direction, and I was holding the kelp up to this light—this would seem to settle the issue by some trick of optics, except that I've never convinced a piece of kelp to repeat the performance, not from any angle, not in any atmospheric conditions. And it's not for lack of trying.

It happens all the time. A leaf of kelp preaches fiery sermons for one day and then clams up; a delicate crab wanders by in the water, matching no species the Peterson's Guide authorizes, and then slips away between some rocks. The naturalist Edwin Way Teale reports that katydids always lay their foamy packets of eggs on low twigs by cover of night—except for the katydid he saw once laying her eggs forty feet up a tree, at midday. On another excursion he came across one which was trying to hide itself among leaves despite being, rather than the usual green, "a delicate waxy coral pink." Nature does in fact respond to questioning with sense, but it's a fleeting kind of sense that thrives on reversal, on a multiplicity of answers: after a time it begins to feel inappropriate when living creatures fall too neatly into place.

Horseshoe crabs are not actually crabs, but rather the only survivors of a unique line of arthropods, the large grouping that includes true crabs and other crustaceans, insects, and all the other creatures with hard exoskeletons and jointed limbs. Atlantic beaches are littered this time of year with the empty exoskeletons horseshoes crawl out from during molting. These sheds are strikingly complete tracings of the animals they

once housed: I always found it hard to believe, when I held a shed in my hands, that what I had hold of wasn't a dead body, but merely something healthily discarded. Every time I returned to them I discovered anatomical details new to me and failed to locate familiar ones, as if the fine structure of these creatures shifted with the tides.

The day after interrupting those mating horseshoes I returned to West Meadow in the late, breezy morning and sat down with one of these sheds for an hour, not moving, barely shifting my weight. I explored this body—there is no other analogy—as one explores a lover's. Half of the experience imprinted itself deeply in my memory, while the other half vanished in seconds, as such memories do.

The shell was about a foot long, jointed crosswise in the middle, with a broad rounded carapace in front of the joint and a smaller, ridged abdomen behind. A spiky telson, as tough and triangular as a metal file, trailed the body from a sinewy ball-and-socket joint. Underneath dwelled five short pairs of legs of varying configurations.

Its two principal eyes—there are something like eight others scattered over a horseshoe crab's body—sat atop its carapace, faceted like a fly's, as hard and gray-brown as the shell. Horseshoes don't use their eyes for much, and not at all outside of the mating season. They use them to make their way up the shore on the full-moon nights when they lay their eggs, and to locate their mates in the first place. During the day, their eyes are essentially useless—they're mainly sensitive to ultraviolet light, which a bright moon spreads much better than the sun—and thus in the daytime

a male horseshoe will pursue rocks and females with equal vigor. The system seems to work fine: you can't argue with 350 million years. Primates like us keep our eyes in front, where the action is, where they can lead the way. Horseshoe crabs stow theirs up top as if in an equipment closet, while the real business of life goes on underneath: a dense interaction between pincers, mouth, and seabed that I can scarcely fathom.

I tugged at the various limbs borne on the shed's underside. They flexed stiffly, arcing in obliquely angled planes. I opened the pincers and closed them, spread the flaps on the hind legs and smoothed them. There was a universe of bodily possibilities here, a nuanced system impossibly foreign. I imagine that even if horseshoe crabs were capable of poetic expression they couldn't convey to us what it's like to live atop such a set of legs, any more than one of us could explain to them all the meanings and modes of our hands. Bodies are secrets: we peer at all but our own across enormous divides.

But I noticed something else on the underside of the shed: the smooth expanses of shell at the back end, near the telson joint, bore shallow fissures, pores, small light hairs, like the skin on the hands exploring them. I ran my fingers over the hairs, astounded. Every now and then one finds a rope bridge thrown across those enormous divides.

Dive deep enough into the particularity of any animal, wander long enough through its strangeness, and eventually you come upon, of all things, yourself. It's incredible, and it's more than a metaphor. This crab and I were quite literally cousins, and our resemblances were family

resemblances: thus the central lesson of evolution. Explorations like the hour I passed with this shed are not ventures into the unknown. They are reunions, long in coming, and they contain that warm joy of discovering your own face gazing back at you from a network of previously unknown relations.

This summer was for me one of those round, focused times in which my work and my leisure coincided almost entirely. Whatever drove me to probe an empty exoskeleton so invasively followed me into the lab in the mornings, and followed me back out to West Meadow at six.

The animals I was studying were the copepods, members of the marine plankton known almost exclusively to scientists, and only known to a handful of them, my advisor Jeannette Yen among them, with anything like intimacy. They are millimeter-long shrimp-like beings that live everywhere there is slow water, and move like beads of pure water themselves. They are a major subdivision of the crustaceans, and among the most numerous animals on earth. Jeannette's project for over a decade has been to decode their behavior, the tiny signs—grander, surely, to them—that distinguish them from inert matters swept by currents.

It takes a microscope to see them as more than specks. As many hours as I spent on the beach I spent hunched over Jeannette's dissecting microscope, the kind with two eyepieces that allows stereo vision, in a windowless lab whose overhead fluorescents needed replacing. The glow of the microscope stage often provided the only light. There the

rambunctiousness of bright June afternoons quieted, and I courted these intent and drifting creatures.

All cats are ornithologists, said the naturalist William Davis. All the things a young cat learns by observation about the family of birds—their physical limitations, their compulsions, their range of sensitivity to the motions that give away a predator—Jeannette and her students search after in the copepods, though with an intention less clear. Less clear, but not, I think, unimaginable in animal terms: our intellects may be well-suited to abstruse pursuits like science, but they weren't invented for the occasion. They've been simmering in our primate family for a long time, retained and honed through our evolution as a means of acquiring food and staying out of trouble. Copepod research is a modern riff on a millions-of-years-old tradition of surveying the neighbors intensely.

My own work didn't require the use of any live animals: it was data analysis heavy on math. All the same, I learned to collect copepods and other plankton off a pier in Stony Brook Harbor, and pored over them through the microscope, watching them flit and hang, flit and hang. And then, having nothing else to do with them, dashed their bucket out over the asphalt in the parking lot. It still gives me pause. Call it a student's background research; call it a carnivore's predation; call it what you will. The images combine, perhaps, in the analogy of a young housecat batting at a half-dead mouse in a field, curious and playing.

The paradox of this kind of research is that even as I strove, by passive or deadly force, to make these animals fess up their secrets, I also

stood in devotion before them. Copepods are miracles. It's mind-boggling that they exist at all, that anything so small can manage to swim and eat and make babies. They are four thousand times smaller than I, and they eat individual rod-shaped cells of algae as I might eat green beans. Each one has an actual heart that beats, and legs, and brain cells, all exquisitely miniaturized—the proverbial world in a grain of sand. I didn't want to be master to my copepods. I was chasing a different relationship with them than that of predator to prey, their deaths at my hands notwithstanding.

A scene from John Burroughs, late-nineteenth-century naturalist, hangs in my mind. He observes that the wolf-spider, in excavating its den, builds a "slight rim or hem" around it to keep the dirt from falling back in. He wonders what it does with the earth it digs out: he searches for a refuse pile nearby and doesn't find one. The wolf-spider isn't what hangs in my mind: I don't even know what one looks like. What hangs in my mind is the image of John Burroughs passing God-knows-how-many afternoons prostrate in the soil before the den of a wolf-spider.

Or again: Teale was walking once through his small swamp on southern Long Island, and decided he needed to know how many seeds were borne on a single cattail. He carried a cattail home and began ticking off each seed on the side of a shoebox.

> At the end of a whole evening's labor, I had accounted for hardly more than a redwing could pull out with one thrust of its beak.…Gradually I worked myself along one side, around the end, and down the other side. More than ten days went by before, to the great relief of the whole family, the tally was complete. It showed that the single head contained 147,265 close-packed seeds.

These tales linger like the lives of the saints. Indeed, the greatest naturalists bear in their work a potent capacity for asceticism—emptying out the workaday self so that something the mysteries may flow in. Within his home, Teale departs from his family; Burroughs bows down to the ground.

The most ascetic of them all was the nineteenth-century entomologist Henri Fabre, who pursued his groundbreaking work upon "a modicum of red earth swamped by stones" in rural France, a modicum only there for him at all because it was good for nothing else. He lived as a pauper nearby, followed countless wasps and beetles through their daily trials, and suffered under the scorn of the villagers. Whatever grandeur lies in such a life doesn't flow, properly speaking, but rather trickles and seeps. "I stop here and I stop there," wrote Fabre; "patiently, I put questions and, at long intervals, I receive some scrap of a reply."

What can drive a person's choices so deep into the soil? Near the end of his life Fabre wrote,

> I have reached the point at which, worn out by the experience of things, we ask ourselves if life be worth the living.
>
> Amid the ruins which surround me, one strip of wall remains standing, immovable upon its solid base: my passion for scientific truth. Is that enough, O my busy insects, to enable me to add yet a few seemly pages to your history? Will my strength not cheat my good intentions? Why, indeed, did I forsake you so long?…
>
> …Come here, one and all of you—you, the sting-bearers, and you, the wing-cased armour-clads—take up my defence and bear witness in my favour. Tell of the intimate terms on which I live with you, of the patience with which I observe you, of the care with which I record your actions.

He sounds like a man chasing something he never reaches: something, in fact, he can barely name. He calls it "scientific truth," but it seems to have as much to do with intimacy, with care, as with knowledge. He sounds like a man trying, with mixed emotions, to adopt himself into a nonhuman family.

There has always been a close link between the joy of scientific achievement and the joy of adoption, or reunion, finding an extended family to sit with on a sandbar. Both are matters of seeing the once alien grow familiar, watching the cold wilderness commute itself into a welcoming neighborhood. We are, after all, deeply social animals, committed to personal bonds practical and symbolic, as surely as we are intellectual animals. Our primate heritage has given us these two means, the social and the intellectual, for making our way through the world, for finding our places. The two ways are closely intertwined.

Thus alongside that old dream of a sensible nature, in which animals smoothly click into place as theory advances, has grown up another dream: the idea that off in the woods, beyond the familiar world of commerce and sandwiches, is a place where the sun shines more brightly. The animals there respond to warm overtures with warmth: if you arrive in the right spirit, they will welcome you into a great bear hug, or shower you in baptism. Looking into nature thus becomes a matter of coming home to a well-kept and loving household, a home where in the evening the lion beds down neatly beside the lamb.

The transmission of this dream to the modern West came largely

through one book by one man, *The Natural History of Selborne*, by Gilbert White. White was a country pastor of the eighteenth century, and a dedicated and gentle naturalist. He was born in the village of Selborne and died there, and seems to have spent the sixty intervening years happy as a clam, corresponding with other gentleman naturalists, spotting ring-ousels on the sheep-down, observing how a hedgehog eats a plantain root. He writes in his introduction that he means to set down a "parochial history"—but he seems only passingly interested in the human inhabitants of his parish. It is among the animals that he finds his community; among whom, so to speak, he beds down.

"The matter of food is a great regulator of the actions and proceedings of the brute creation," he writes: "there is but one that can be set in competition with it, and that is love." It's a marvelously faithful vision, marvelously trusting, and deeply integrated: that is, the only difference in it between the pursuit of scientific logic and the pursuit of love is a matter of emphasis, what natural proceedings he chooses to look into today. He looks at owls and draws from their behavior a thread of logic, the convoluted logic of bodies: "When owls fly they stretch out their legs behind them as a balance to their large heavy heads; for as most nocturnal birds have large eyes and ears they must have large heads to contain them." A few months later, he is watching house-martins, and draws a note of warmth from an unlikely place:

> At first when the young are hatched, and are in a naked and helpless condition, the parent birds, with tender assiduity, carry out what comes away from their young. Was it not for this affectionate cleanliness the

> nestlings would soon be burnt up…by their own caustic excrement.…Yet, as nature is cleanly in all her ways, the young perform this office for themselves in a little time by thrusting their tails out at the aperture of the nest.

Such tenderness is everywhere for White. Sense and order, too, are everywhere. To uncover them requires only time, patience, and a certain sympathy.

"Nature comes home to one most when he is at home," writes Burroughs; "the stranger and traveler finds her a stranger and traveler also." White was supremely at home in his home. Unlike Fabre, he appears to have found what he was looking for. He flows out onto the page, a subtle and complicated but unified animal, as un-self-conscious as the birds. I suspect it's the feeling of centeredness, of grace, he exudes that made his work and his Selborne so iconic. The generations after White's lived through the growing pains of the Industrial Revolution, in times that made strangers and travelers of great numbers of them. British expatriates latched onto his book and carried it with them all over the world.

This last fact reminds me of a story Loren Eisley tells, of how he "once saw, on a flower pot in my own living room, the efforts of a field mouse to build a remembered field." There was an actual field nearby in the process of being run over by bulldozers, and thus producing refugees. Eisley walks into his apartment and finds a heap of earth on the carpet, and "a full-fledged burrow delving downward among the fern roots" in a pot. "I could visualize what had occurred," he says. The mouse

> had an image in his head, a world of seed pods and quiet, of green sheltering leaves in the dim light among the weed stems…Somehow in his flight he had found his way to this room…. [H]ere he had smelled green leaves and run quickly up the flower pot to dabble his paws in common earth. He had even struggled half the afternoon to carry his burrow deeper and had failed. I examined the hole, but no whiskered twitching face appeared. He was gone.

This mouse's dream, like ours, observes Eisley, was a small thing, and carried far. I think of this mouse and then I think of Englishmen launching themselves across oceans in the service of an empire, White's book in hand, while back home factories swallowed up the sheep-downs.

Anyone now who is still driven by the dream of a life integrated gently into nature is left, like Fabre, like this mouse, to chase it on scraps of land: the scraps of land, the scraps of human endeavor, which an imperial economy discards as useless. Thus national parks and nature preserves, walled off like the soil in a flower pot; burgeoning numbers of household pets; and, too, the natural history essay, the genre that White invented and imprinted with his vision.

It's as if we've come to live as strangers and travelers always, as if we can't figure out how to arrange a ticket home, or can't remember what home port we departed from in the first place. Never, in three months in suburban Stony Brook, did I meet my next-door neighbors; I don't think it even occurred to me until afterwards that this was odd. I wear wool sweaters, but I have never so much as visited a sheep-down.

The insidious thing is that as we industrialize the landscape, we seem to industrialize our dreams as well. The science of ecology has drifted far from White's nascent interpretation, in which he saw a

congruency between the demands of food-gathering and the demands of a mother's love: the language of ecology in this century is largely the language of high finance. Modern ecology envisions nature in agro-economic terms, as a chugging industrial system, as a set of commodity transactions. Chemical energy is the leading currency. Plants are producers in this system, animals are consumers, and all of them, finally, are not beings, but resources, devices, and stockpiles.

In the spring when the vast nation of horseshoe crabs assembles by Delaware Bay to mate, they are gathered up and shipped off by the truckload, still alive, to be bandsawed into chunks and then shipped back out to the shore as bait in commercial shellfish traps. A stout, mature horseshoe, with its eyes that read the moonlight and its ten probing, scuttling legs, might fetch as much as eighty-five cents. This procedure, incidentally, makes humans (and less directly, those commercial shellfish) the only predators on adult horseshoe crabs.

Their blue blood contains a clotting agent useful in biomedical research, and so a number more each year are lifted from their mating rituals, driven off, set down on racks, and drained of that blue blood, at some point in the extraction losing whatever consciousness they have. Well, again, as Dillard said, here we all are—but how did we end up meeting like this?

It's not that the economic and mechanistic metaphors of modern biology are wrong—they explain many things spectacularly, in fact—just that they seem rather cut off. As mentioned, my work on the behavior of

copepods this summer involved no copepods, but only a fast computer, some calculus, and a videotape from a few years before of some drowsy copepods swimming in a small tank in Wisconsin. Descartes' clockwork vision of animals was released at some point from its context, and has been expanding ever since like a marauding army. Jean Baudrillard speaks of the "empire of meaning": we march its banners across the landscape, down into the crevices, sweeping through even our own bodies and souls, as fast as our machines will carry us. Who flung open the gates? How did the dream of sense and order roam so far from the dream of communion?

Economic transactions aren't much to build a life together from, as is clear from the state of human relations in places like Long Island. It can't be coincidence that we reduce animals to the status of consumers and resources at the same time we find ourselves similarly reduced. As Baudrillard writes, between the state of animals and the state of humans, there remains "an unexpected reciprocity." He notes that "only the inevitability of death" on a factory farm "renders the example of the animals more shocking still than that of men on an assembly line."

In both the human and animal spheres, relationships have been fragmented into the economic and essential on the one hand, and the sentimental and expendable on the other. It's as if social bonds were now entertainment, and not matters of survival; as if the desire of a house-martin to see her chicks protected did not spring from the same body as her desire for worms to eat.

The unity of all these things—physical and spiritual hunger, cooperation and exploitation—follows a complicated logic; but this is how bodies have always done things. Owls need big eyes to see in faint light, and so they need to be able to stick their legs out behind them when they fly. Emotions both are and are not distinguishable from the neurotransmitters that produce them. Death is tragic but also essential: a mother house-martin decaying in the grass means starvation for her chicks, and starvation averted for any number of scavengers. Nature operates by a plurality of truths. A strict and abstract sense of the Good tends to obscure this: nature is not in fact cleanly in all her ways, as White put forth, but rather cleanly in half of them and in the other half ripe and grimy. A pig rolls in mud to keep cool; for a pig, rolling in mud is good personal grooming.

The hard-line imagery of modern ecology would seem, in contrast, to be relentlessly realistic, but it too tends to obscure natural truth's multiplicity. Economic values get torn from their context and slathered over the landscape indiscriminately. At the close of the Victorian era, for example, Lester Ward condemned nature for carelessness. It is wasteful, he said, for a creature to lay thousands of eggs so that one or two may survive; it is inefficient to let streams meander. "Nature has no economy," he said: humans could run the place better. Ward grew up on a Midwestern farm.

Much modern praise for animals connects with its recipients no better than the condemnations. To praise horseshoe crabs for being so

useful in medical research says almost nothing about horseshoe crabs; to praise them for being so well-designed that they have had no need to evolve for 350 million years says a bit more, but not much. Biologist Brian Goodwin was quoted in *The New York Times* recently, expressing concern over the genetic engineering of plants and animals to suit our needs. "Organisms are not merely survival machines," he says. "They assume intrinsic value, having worth in and of themselves, like works of art." An interesting distinction. Animals are more than machines; they are works of art. What kind of music do you play here, ma'am? *Both* kinds, Country *and* Western.

The work of art and the work of engineering: both of these images are far cries from the praying mantis named Dinah whom Teale kept as a pet one summer, who, as much time as he spent watching her, spent more time watching him. So too are they a far cry from the randy male horseshoe crab who, before I could get out of his way, was pointily nipping my toes, testing to see if I might be the desirous creature he had paddled all those miles for. Whether one understands animals as exquisite machines or exquisite sculptures, one participates in the enormous delusion that, as Paul Shepard has written, living creatures were *made*, fabricated, when in fact they have *grown* under their own power, by their own logic, over two billion years.

When we understand animals as having been designed—according to engineering principles or aesthetics, no difference—they become mere stuff, mere representations of grand ideas. In the same way, Disney and dog sweaters—and too, the more smothering of the communal visions in

the school of White and Thoreau—reduce animals to signs in a system of primary-color emotions. Animals thus become tokens, flat shapes to toss about, or to toss away. To this way of thinking, real value lies in the mind that thinks and emotes, that streamlines economies and seeks after civilized, not brutish, love. The bodies that implement these things become chopped liver.

The old desires, for a world of blessed logic and a world of warm companions, still linger on behind all our dislocations. But they lack an anchor, and without it our dreams balloon up into odd, often grisly shapes. Life in the wild, as John Berger puts it, becomes "the starting-point of a daydream": the stories we tell come to begin and end with our own psychic life.

Consider, for example, coyotes. Shepard notes that interpreters read Navajo stories about Coyote almost exclusively as speaking about Navajos, or about a universal unconscious, and not at all about coyotes—as if coyotes lived only in the imagination and personality, and not the desert shrublands. Meanwhile the flesh-and-blood coyotes of the American West have been generally either condemned as chicken-thieves and murderers, or defended under the rubric of animal rights—both sides of the argument merely extensions of our social contract to animals who live by a different logic. Both sides fly right by actual natural history, much as did the courtroom trials of pigs, cattle, and dogs during the Middle Ages. The usual punishments for, say, a pig that trampled a boy, or a swarm of locusts that devoured a field, were execution, if practical, or

excommunication. Coyotes today seem to face similar options.

But there is an alternative to simply absorbing animals indiscriminately into our systems: we can acknowledge the fact that we have been contained in theirs from birth. Thus the missing anchor I speak of: our continuity with the animals in body and behavior, the ancient intuition formulated in modern terms as the story of evolution, the story of our descent. It's a tale well-known, but devilishly hard to live by.

Thus our estrangement. Still, I look at the shell of a horseshoe crab, then look at my own hands, and feel compelled to try to erase this blind spot from my vision. What other family do I have? What other home do I have, besides this not-quite-clean, not-quite-organized, not-quite-compassionate world of big-eyed owls and katydids and sand? My own nature is refracted, like it or not, through the house-martins, the arthropods big and small, the fungi, the tunicates, the bryozoans, the reptiles; the tall apes who begat my species and the lice who nibbled them. Have I not also grown up over two billion years upon their nourishment, the product of their intimacies? Do my blueprints lie elsewhere?

The story of our natural family belongs, essentially, to Darwin, just as the story of our natural home belongs to White, and Thoreau and Burroughs and the others after him. Of the two Darwin's is the harsher lesson. This may be because it sprang from a harsher experience, from a corner of the world less accommodating to our tastes.

Darwin grew up in White's England, in a world of green pastures and singing wrens and God's grace abundant. His formative voyage aboard

the *Beagle*, however, showed him a natural kingdom much less Peaceable, a face of the earth he didn't anticipate. "I am tired of repeating the epithets barren and sterile," he wrote from northern Chile in 1835, three years into the voyage. Five months later the ship landed among the Galápagos, where a century and a half later Annie Dillard sat and stroked the neck of a giant tortoise. Of Chatham Island he wrote,

> Nothing could be less inviting than the first appearance. A broken field of black basaltic lava, thrown into the most rugged waves, and crossed by great fissures, is everywhere covered by stunted, sunburnt brushwood, which shows little signs of life. The dry and parched surface, being heated by the noon-day sun, gave to the air a close and sultry feeling, like that from a stove: we fancied even that the bushes smelled unpleasantly.

These islands made no sense. He writes that "such wretched-looking weeds would better have become an arctic than an equatorial Flora"—that is, they had gotten their vegetation backwards, according to the life-zones theory of the time. The animals were all strange; for some reason, half the land birds were finches; the work done by deer and their cousins elsewhere was here done by enormous tortoises, and the tortoises varied in form from island to island. A powerful theory of evolution lay in these things, but also a shocked, disturbing disappointment in the way the world was run. The only parts of England these islands reminded Darwin of were "those parts of Staffordshire, where the great iron-foundries are most numerous."

After objecting to the bushes on Chatham Island, he goes on,

> As I was walking along I met two large tortoises, each of which must have weighed at least two hundred pounds: one was eating a piece of cactus, and as I approached, it stared at me and slowly walked away;

> the other gave a deep hiss, and drew back its head....The few dull-coloured birds cared no more for me than they did for the great tortoises.

So much for love and kindness. They're the words of a man who suddenly finds himself very far from home, a stranger and a traveller. Darwin's experience was far from unique during this era of exploration. From such haunting disappointments sprang, eventually, the callousness and scornfulness of Ward and his contemporaries: the eerie Victorian idea that estrangement from nature might be not a prison, but a shining point of pride. The birds don't care for me? Well, then, they are dull-coloured, and I don't care for them either.

But just as the illogic of the Galápagos eventually revealed itself to be a logic of a different sort—the meandering logic of evolutionary history, the trickster logic of bodies and their ecology—so does the lack of love and care Darwin found eventually turn out to be its own kind of intimacy. Dillard strokes the neck of a tortoise. We are all kin; we find ourselves in strange places, with strange neighbors, and so we reshape ourselves as we can. Our bodies merge fluidly: evolutionarily, sexually, carnivorously. There is, finally, no living entity in the world except the whole lot of us combined.

Shepard writes of "a universal metabolism." The phrase refers to the deep accord that lies beneath the world's apparent discord: "a balance of dissolution and construction," attained not by any fiat or foresight, but by internal impulses. It's not so much a metaphor as a recognition of self-similarity: the way the vital processes of a cell or a body are repeated across

a local landscape like West Meadow, or over the globe as a whole. Perhaps making use of such self-similarities, letting a part speak for the whole, is the only way to express the qualities of a world so plural. A horseshoe crab may stand for the world's solidity, its indifference to changing conditions, the sheer improbability of its design. A dead horseshoe crab, stiff, cracking, and fetid, may stand for other things. And to express the world's fluidity, the perfect, perpetual motion of its parts, there are the terns.

Their flocks came and went from West Meadow as if driven by some polyrhythmic tide. There was only one day that I got a look at them up close. I was idling with a few friends out near the sandbar, now well submerged, the water up past my chest, while two or three sets of parents and brood hovered low overhead. They are perfectly, entirely streamlined birds: they are a brilliant white, and seem constructed of pure aeronautics. They turned under each other and hung in place against the wind, wings out straight, the flock drifting slowly to the south. They didn't noticeably avoid us; as I'm sure they knew, if I were some sort of leaping sea jaguar I couldn't have caught them.

They suspended themselves from the wind within a narrow range of heights, each bird diving at casual intervals. They drop like they're dead—so much so that the first time I saw one do this, I thought it had had a heart attack, and the second time, I thought I was seeing things. Still, a tern pulls out inches above the water from more dives than it completes, and astonishingly often it emerges from a completed dive with a small fish in its beak, flipping it and swallowing it on the wing. Eventually, as

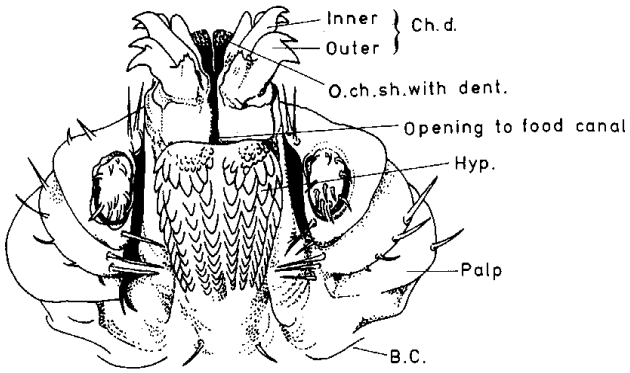
the sun began its descent, the flock settled down into a strand along the shore, the birds taking off lightly and purposefully as the waves rolled up to them. They reminded me powerfully of Barry Lopez's description of a herd of Arctic muskoxen: "they were so intensely good at being what they were. The longer you watched, the more intricately they seemed a part of where they were living, of what they were doing."

The terns have no monopoly on this quality. The schools of fish they eat move in their element with the same luminous grace, the same exquisite appropriateness, turning together, which is to say, intensely aware of each other. These fish eat smaller fish, by late June many of them schools of alevins, or juveniles, silver and bright—I held perfectly still in the shallow water and a hundred of them beat solemnly against my ankles. Alevins dart wherever they go so as not to give away their presence too soon to their prey, which includes the copepods. For their part the copepods manage to navigate agilely, without eyes, through a landscape made up of tiny vortices, invisible channels, bow waves thrown off by the fish hunting them. The water that appears blank to us has contours and fine structure for them, as the air does for a gliding hawk.

The flow of energy and nutrients between these creatures does not add up to a centrally-planned economy; and their millennia of feeding each other and reshaping each other have not been about love. But as pieces of nature tend to recapitulate the whole, and as we are pieces of nature, the musky sense that binds together the chaos of lives here is close to us, written in our flesh, even if we dream of more polished things.

There is the old game of trying to figure out what animals are by knowing only our own polish—this always ends in assigning them identities that didn't grow on them—and then there is the other possibility, figuring out who we are by watching the animals, straining after them, pining after them, giving ourselves over, rebuilding ourselves from the clay of the earth. "The buffalo grazing quietly in the presence of lions," writes Shepard, "is both a reality and an idea; the rabbit hunching,…a coyote eating some afterbirth,…are all a richness of ideas pouring into the world." These creatures shape us, as parents shape a child, first by a bodily intimacy, and then by example.

There can be no estrangement, in this style of thinking: there is no space in which a life may be solitary. I am slowly learning vulnerability this way, and trust—trust that through its many turnings, nature has anticipated who I am.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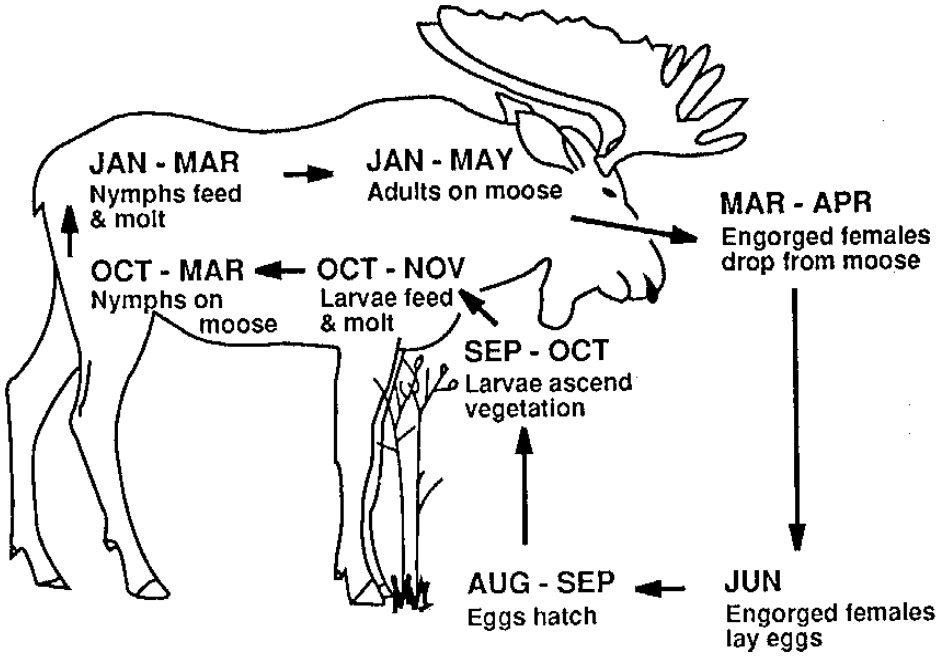
JAN - MAR
Nymphs feed & molt
JAN - MAY
Adults on moose
MAR - APR
Engorged females drop from moose
OCT - MAR
Nymphs on moose
OCT - NOV
Larvae feed & molt
SEP - OCT
Larvae ascend vegetation
AUG - SEP
Eggs hatch
JUN
Engorged females lay eggs

I was poking about belly-deep in the water at West Meadow one afternoon, swaying gently along with the flotsam, browsing, when I spotted a small crab hanging at the surface. I swept it up, and abruptly it seemed to jerk out of my hand back into the water. It unlocked into pieces as it hit the surface. The crab had been holding itself together, evidently, with the weakest of glues, and now—I've never seen this happen so literally—it simply fell apart. Its smooth carapace floated out from the rest of it. Its many legs, tipped by delicate points, tumbled away in slow motion. Its innards unraveled into a cloud; its face came off. What was so recently a being, feeding on morsels and busily growing up, was now a teaspoonful of chitin and organ meats, drifting to the bottom so, so slowly.

So much for the Peaceable Kingdom. I wanted sharp facts, and I got one: this is how bodies work, bottom line. They fall apart. That's how new bodies get made—from the parts. If a body doesn't fall apart, it gets chewed apart.

Every beach I visited seemed to concur on this point. I headed out one weekend to Montauk Point, at the tip of Long Island's South Fork. The South Fork is where every vacationer in the New York area heads on weekends; I was anticipating something bright and friendly. The beach at Montauk Point, however, turned out to be a rank, narrow, rocky strip between low cliffs and frayed hillocks on the inland side, and dark, kelpy stones and an irritable Atlantic Ocean on the other. It was built of the kind of coarse sand that made every stroll a trudge. Only a few minutes there

and my thoughts were assaulted and captured by dead matter: the variety of it, and the sheer tonnage.

Dried tangles of kelp, tossed out by the waves, slumped everywhere in great arcs. Sand fleas who had been busy feeding bounded and scattered from them as I approached. The shells of sea slippers, clams, and crabs of every form lay in the sand in various states of disarray: whole, perforated, shattered. The sand itself, for that matter, was built with these shells: I walked on not just the bones of the earth, but the pulverized bones of fine creatures, who once roamed this coastline quick, famished, amorous, poised. Gulls pulled at whatever meat was scattered among the rocks.

Horseshoe crab sheds and corpses were strewn everywhere, a memorial to their furious mating season, now on the wane. One horseshoe lay splayed on the stones, its forehead cracked in two directly through its right eye. Another, uncommonly intact, caught my attention; I crouched over it and after a pause, flipped it. Most of its legs were still attached, skeletal tubes emptied out by scavengers. It was a male, small, but sexually mature: it still bore the mating foreclaws with which it would grasp a female. I tried to extend one, opening the fine planar joints of the leg, and it snapped off at the wrist, the exposed fibers glistening and drying quickly under the sun. “Nature,” said Thoreau, “is inhumanly sincere.”

Yes, well, it’s comforting to think of such goings on as inhuman, the same way it’s comforting to live in neighborhoods where the unravelings of our own bodies and our prey’s bodies are hidden discreetly from sight. On the surface of things, in a place like Long Island, death

seems to have been made extraneous to human life: unnecessary, an interruption. We appear to have set aside a space in which to live in which we and the animals are cleanly in all our ways and treat each other politely. That bodies-unraveling, red-in-tooth-and-claw business might be fine out in the wilderness somewhere, but we are civilized human beings; these are the *suburbs.* We don't leave our bodily members scattered over the carpet, like the crab that unlocked itself all over West Meadow. We don't stick forks into each other, like the horseshoe crab who comes to scavenge bits of it off the seabed. Even my landlady's cats were declawed and raised on canned food, rather than mice.

Beneath the surface, however, the distinction between peaceful, oak-lined neighborhoods where even our pets are never uncouth and the lurid wilderness where animals hunt each other in strange and exciting ways evaporates into fantasy. The way we obtain our hamburgers and crab cakes is lurid enough. From the beaches at Montauk, where squat armored creatures battle each other under the waves, to the nearest human habitations is perhaps a five-minute walk down a paved road. There's only the one system of lives in the world. "Wilderness" and "neighborhood" don't identify pieces of land; they identify the particular dream one chases.

In early July I was chasing neighborhoods Gilbert White-style, and chasing them far afield. I was getting impatient for beauties less subtle than West Meadow's, messages less demanding. Thus for Fourth of July

weekend I headed off with Vanessa, a fellow marine sciences student, to go camping on Indian Island, at the inland tip of Peconic Bay.

If there's any place on Long Island where one can go to contemplate nature in its purity, it isn't Indian Island, a one-hundred-RV campground just barely outside the city of Riverhead. I was in such a good mood, though, that I did anyway. I serenely contemplated nature from the park's tiny beach. I serenely contemplated in the leafy woods, I contemplated more inquisitively, but still serene, in the strip of odd scrubby dunes between them. The land was woven together perfectly, fresh and clean. The sun was hot; I scuffled back to the campground, towel slung over my shoulder, the dirt road wandering up between my toes. A boy from a nearby campsite beamed as he introduced me to his dog, which I scratched behind the ears. Here was the archetypal Independence Day weekend: I saw nothing on the American continent today but friends and neighbors. I was raised up from the rich soil like Adam; I was a dweller in Eden, at home in a landscape of generous hospitality. And in the car on the way home, I found a fat tick dug into the back of my shoulder.

I imagine it sidled onto me as I brushed against some stem and then crawled up the outside of my shirt, under my collar, and down my shoulder blade until it found a spot it liked. It must have found me while I was in the woods that morning, which means that there was a three-hour stretch in which the tick was sipping at my blood, as serene as I was. But when I found it welded to me in the car, I ruined the blissful moment for both of us in a hurry—my own hospitality, apparently, not so generous.

I ripped it off—not the wisest thing to do with ticks, especially in the land of Lyme disease—luckily a piece of my skin came off with its jaws, rather than its head coming off its neck and staying buried in me. I felt a little crazed. Vanessa kept on driving; I trapped the thing in a fold in a plastic bag and did my best to murder it. It was a quarter of an inch long, a sickly beige, and, incidentally, one of the horseshoe crab's closest living relatives, though this was not on my mind at the time. I was too busy hating it, scorning it, staring in awe at it, and fearing it in quick succession. I wasn't observing very closely what the tick was doing during this time: wriggling, probably, losing some legs under my fingernail, definitely not dying. Just a few days earlier, I had been reading Kathryn Harrison's account in *The New Yorker* of the battle she fought with a tick wrested from her daughter's head. She has the tick imprisoned in a coffee mug, floating in white rum from a gift bottle, and she writes,

> The rum brings the tick horribly close to my eye, so close that the bloated gut seems planetary in its hugeness. Yes, huge: there is nothing bigger in the world than this tick stuffed with its minute apparatuses of consumption and digestion.

I knew the feeling.

I finally flung the tick out the car window and it whipped behind us at fifty miles an hour. I wouldn't be surprised if it made it back to the woods. My shoulder healed in a couple of days—no Lyme disease. Then a few days later, back in Stony Brook, as I sat down to lunch at the picnic table behind the lab, a spider bit me on the thigh, in response to being sat on. I cursed at it; a week later, the inch-wide welt on my leg started to subside. I don't know if the spider got away, and, frankly, even now I find it hard to care.

There's no war-glory in these encounters, none of that crimson-streaked, lion-taking-down-a-springbok atmosphere that the nineteenth-century Romantics and their modern successors—TV wildlife specials—find so satisfying. There's precious little of it out in the wild anywhere. Animals in general just aren't angry at each other, even when they're eating each other, and they fight dirty. Most of the violence in the world isn't combat, but something slower, more banal, more sniveling.

Nature isn't really so red in tooth and claw; it's more like black comedy, occasionally dry and understated like the dead kelp on a beach, more often slapstick. The world's full of raucous marauders (like the gulls who snatch up spider crabs and drop them on the rocks from forty feet up, repeatedly, to crack them open), practical jokes (like the spider crabs discovering that out of the water they're too weak to lift their own pincers to defend themselves), and plenty of raw meat—a real carnival, in the sense of the word that honors its linguistic link with *carnal*, *carnage*, and *chili con carne.* Try to spend a weekend inhabiting a nobler or friendlier kind of wilderness, and some greasy critter shows up on your shoulder to remind you how good you taste. This is our family. We're going to be meeting at these holiday barbecues till the end of time.

There is nothing lovable about ticks. They're microcephalic; even though they have eight legs they seem to creep, rather than walk; they have an ignoble livelihood, pursue it shamelessly, and spread diseases to boot. I never expected to react to them as extremely as I did. Maybe my repulsion and Harrison's are a legacy of our hominid ancestors, who had

more serious reasons to avoid parasites. Maybe ancestry has nothing to do with it.

It's draining, though, to try to stay mad at ticks. They so obviously don't reciprocate the feeling. We may understand our dealings with them through the metaphors of social relationships and emotional exchanges, but I can't imagine how ticks would have evolved to do so. Our emotions are irrelevant to them, though our blood is very interesting indeed. Besides, if a tick feels anything for the body that hosts it, wouldn't it be a cozy, peaceful love, like a suckling infant's? I don't think the fear of disease explains my harsh reaction to being bitten by one. Why was I so unwilling to be a beneficent mother?

Harrison writes,

> I shake the mug, and the tick bounces around inside like a bean.... A tick wants blood more than anything, I know, and as I say the words to myself, as I articulate the tick's longing, I understand what I myself want: to make it bleed, to make it surrender what it stole from my child. It's not that I demand this creature's imagined remorse, but what was Sarah's must be returned. A nervous, cool dread uncoils within me.

What was my daughter's must be returned: in the end, our interactions with other creatures aren't about remorse or conscience, not about civility or offensiveness, but about a dreadfully earnest bodily exchange. We aren't merely socializing; we're scraping our lives together, partners in a grassroots economy in which we trade the flesh as currency. As Harrison said, there is nothing bigger in the world than a tick with its "apparatuses of consumption and digestion." This is the level on which our relationships with animals achieve mutuality—the level on which we

click into place as segments in great cycles. A tick takes a drop of blood, and Harrison or I struggle to reclaim it.

The emotions that accompany these exchanges are secondary—although considering what's at stake, it seems only appropriate to get pretty worked up. A drop of blood is a pittance, merely symbolic, that is true. But the drop over which I'll fight a tick doesn't symbolize a sentiment or a principle; it symbolizes a larger quantity of blood.

"A nervous, cool dread uncoils within me." This is unfamiliar territory for most of us, though we've lived here all our lives, and as Thoreau said, it is awfully sincere. It often feels as though the logic of this economy were remote, hidden, belonging to some alternate order of human life. "A peasant becomes fond of his pig and is glad to salt away its pork," writes John Berger. "What is significant, and is so difficult for the modern urban stranger to understand, is that the two statements in that sentence are connected by an *and* and not a *but*." The crucial mystery—which the economic language of ecology hints at, but still holds at arm's length—is that death, decay, and consumption are not accidents and not wars, but collaborations. This is the mystery of the universal metabolism Shepard speaks of: the awesome balance between carnage and growth in the world, a balance as intricate as the network of capillaries in your hand.

If the machinery of the world's metabolism isn't readily apparent, it might be because most of it is so very small. Dillard says she heard once that the "average size of all living animals, including man, is almost that

of a housefly"—and that's just the animals. Factor in the protists, the algae, and the mountains of bacteria that keep the rest of us going, and the average, I'm sure, would withdraw to a microscopic scale. Meanwhile, we pack our eyes along a full five feet or so above the ground. Most of the business of life you just can't see from up here, at least until it crawls up your leg.

There's a small, elongate pond tucked into the middle of the SUNY Stony Brook campus—Roth Pond it's called, after the dorm complex that surrounds it—where Jeannette took me early in the summer to sample some freshwater plankton. One humid afternoon mid-July, I stopped there again on my way back to the lab from the life sciences library. It was quiet here, save for the rhythmic *cheet* of the frogs hidden in the reeds. Dragonflies, their race even older than the horseshoe crabs', periodically swooped and dipped across the water, as fluid and precise as terns. Slightly less often an undergraduate would pass by. Out in the center of the pond, a monumental carp tried to blend in, making the most of an odd situation.

Other than these creatures, though, the murky pond seemed perfectly still from where I stood, empty. The sun was so bright that everything looked slightly blasted. I lay down on the soggy ground, my face so close to the water that I had to breathe shallowly to keep from rippling it, and the pond woke up, suddenly metabolizing hard. A school of alevins pulsed by, rushing and slowing like blood in an artery. The floor of the pond was tawny and matted, dotted with bubbles of oxygen excreted by algae. At intervals a bubble flew up and popped silently at the surface,

rebuilding the earth's atmosphere. A clan of tiny snails migrated inexorably over the spiky underwater plants. I had read just that morning that some aquatic snails could glide upside down on the underside of a pond's surface, hanging off the surface tension; now I watched, gaping, as a snail twisted itself off a high leaf, maneuvering glacially, and cruised off in just that way, grazing like an upside-down sheep. A legion of ants found my toes after just a minute or two, scurrying over the silt I lay on. Something that looked suspiciously like an ant ambled along underwater.

My jeans were still damp when I got back to the lab. A plastic bucket of leftover pond water an inch or two deep had been sitting in the corner of our sink ever since Jeannette and I took that sample a month earlier. I had been plainly neglecting it; now I started eyeing it more curiously. A few largish bits of pond bottom still sat in the waste water. With an eyedropper I transferred a few teaspoonfuls into a petri dish and slipped it onto the microscope stage. I looked through and teased the dish from side to side with my fingers to bring the bits of sludge into view. At this magnification they opened up like a great three-dimensional forest; and they were inhabited.

It was like stumbling into Brigadoon. The waste bucket had been, to the best of my knowledge—to the extent I thought about it—waiting inertly in the sink for me to wash it out. It was the *waste* bucket after all, the water out of which we had filtered the interesting animals like copepods. But a fragment of the pond had been carrying on its business there all this time, dreadfully out of context, and now lay scrambled in a

petri dish, illuminated harshly from below. I was mesmerized. Creatures like transparent cigars curved themselves through apertures in the vegetation, seamlessly controlled. Paramecia cruised in long arcs through the clearings, rotating slowly, grandly, around their long axes, their profiles shifting sensuously.

I slid the dish a quarter of an inch. One darker creature shaped entirely like a caterpillar, stubby legs and all, crawled up a plant fiber. It bumbled, but with a certain delicacy, like an elephant on tiptoe. I plucked out a strand of my hair and lay it across the microscope field to check its width against the caterpillar's length. About one third.

Almost everything swimming swam fast enough to escape from my field of view in only a few seconds. Thus I launched into a game I had learned to play with the copepods, of tracking the animals as best I could with the eyedropper, siphoning them up, and depositing them in droplets in a fresh petri dish, so that they were effectively caged and couldn't wander off. It was a maddening endeavor—the mouth of the eyedropper was dozens of times larger than the creatures I sought, and its intrusion scattered everything—but the process was punctuated by frozen moments of success in which I stared awestruck at one of these tiny, hungry lives, bobbling in circles under my gaze.*

With care one can wick away the water in one of these droplets

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*Berger, on the subject of caged zoo animals: "The space which they inhabit is artificial. Hence their tendency to bundle towards the edge of it. (Beyond its edges there may be real space.)"

until the animal inside is barely surrounded and can't move at all. This is useful for studying their anatomy, or for gluing them to things. One series of experiments by Jeannette and her collaborators involved supergluing copepods to thin wires or strands of hair, in order to watch the currents they set up in the water to draw algae or prey animals toward their mouths. They create these currents by paddling their many legs.

> As it swims and hovers, the copepod's laminar feeding current takes the unstable nature of small-scale turbulence, organizes it, and makes the domain a familiar territory within which signals can be specified in time and space…giving the copepod early warning of the approach of a prey, predator, or mate.

Seen from the outside, the act of gluing copepods to wires and videotaping them resembles the copepods' own behavior: a matter of organizing an unstable environment into a familiar territory, squeezing predictive power over one's neighbors from a turbulent landscape.

I isolated one ovoid creature in a drop, its surface delicately vented, its innards full of earth-tone organelles, and started drawing the water off, to try to convince it to stop wheeling and sit still. The edges of its drop released tiny beads of water as they shrank smoothly across the plastic; I could just see the twisted-up corner of the Kimwipe I was using to wick up the water through the microscope. Then my hand vibrated and the drop was gone, vacuumed up. I searched frantically over the Kimwipe for my charge, thinking I might be able to reanimate him, but I found no trace. I dumped the forest in the petri dish back into the waste bucket, switched off the microscope, and left sullenly to do some more programming at my workstation. A few days later I tossed out the water in the bushes and

washed out the bucket.

All summer long, as I kidnapped plankton from Roth Pond and Stony Brook Harbor to the lab and subjected them to such extremities, I found my behavior strange, a bit distasteful; I seldom left the microscope stool exactly happy. Yet I persisted, without much to say for myself. I thought sometimes of a scene from John Burroughs, normally so pacific. He's relating how once on a November day he dug out the four-foot tunnel leading to a chipmunk's burrow, and found a full two quarts of wild buckwheat seeds in the larder. "Think of the amount of patient labor required," he exclaims. "Probably every seed was husked with those deft little hands and teeth as it was gathered, before it went into his cheek pockets, but what a task it must have been!" Then he adds, "Digging the little fellow out, of course, brought ruin upon his house, and I think the Muse of Natural History contemplated the scene with many compunctions of conscience,—if she has any conscience, which I am inclined to doubt."

I was starting to wonder about the status of my own. The morning of the day I left Indian Island—during the interval in which the tick sucked at my shoulder and I hadn't realized it yet—I was wading with Vanessa at the advancing edge of the tide on Peconic Bay. We stood on a dot of beach down a short scramble path from some picnic tables; shady land faced us from across a narrow inlet. A school of alevins pooled, indecisive, halfway between my ankles and a patch of half-submerged beachgrass beside me. I was in love with alevins this week. I wanted to

look at them. I lunged at them with cupped hands, trying every trick I could think of to catch one.

Vanessa, who's studied marine biology a lot longer than I have, was displeased with me. "How would you like it if some giant person came down and scooped you up…?"

"I know." I tried cornering them against the shoreline. No go; they slipped away.

"Just leave them alone."

"I know." I tried cutting off their escape route with my legs; they dodged me and dashed to regroup. I was losing patience with them.

"You're just exploiting the difference in size between you, your power—"

"I know!" I knew: I knew very well that you don't treat animals like toys, that there's no honor and little point to an investigation that does, that a deeper satisfaction lies in keeping one's distance and sneaking glances as the animals allow.

Rightfully, none of our dealings with animals are purely up to us. They are always exchanges, negotiations. Scratching a mopey dog behind the ears in a campground, clawing at a tick, chasing a young fish through the water: each is its own kind of bodily conversation, in which we may speak harshly or gently, as we choose. Animals respond to us as we fit into their categories, just as we respond to them: I become a tank of warm blood or a particularly ponderous aquatic predator, depending on the circumstances. A domestic dog, I imagine, responds to me from within a

muskier version of my own social awareness. I feel it's good for me to enumerate the list of things I become for the animals I interact with. I do it to remind myself that I am, by my birthright, as multiple and convoluted as they are, and also to remind myself how ponderous a predator, how much like a domestic pet, I really am.

Case in point: I'm reading in my landlady's backyard one afternoon. Some squirrels go about their business nearby, foraging in the dead leaves like paramecia. A handsome male sparrow lights in a tree, looking about. I see it and I tense and strain at it from my chair, trying to will us into contact, trying to will *something* into happening—the sparrow hops to a lower branch and flies off. I don't think it noticed me there at all. I sit back, embarrassed by my desperation.

I realize suddenly how much the way I gawked at that sparrow reminds me of my family dog, who will spot a squirrel nibbling a seed on our back fence and freeze, wriggling on her feet, squeaking a bit, trembling with longing. Sometimes she begins to stalk, creeping toward the squirrel with a half-remembered skill she never actually learned. She's never come close to catching one. I can't imagine what she'd do with a squirrel if she ever succeeded—or what I'd do with an alevin slapping about in my palm—but stare and stalk we do.

The Muse of Natural History, if that's who urges me on, does indeed seem low on conscience. What she seems high on is simple, toothy carnivory. Good breeding, in any species, only goes so far: suburban dogs and suburban humans alike still carry their ancestry in their hearts and

paws. I wager that any reason Burroughs has for wrecking a chipmunk's larder, any reason I have for straining at a sparrow, if it's been concocted in the last ten thousand years, can only be a new coat of paint on a more basic need. Hunger is hunger: at root, all modes of communion run together. There's the famous passage in *Walden* in which Thoreau writes,

> As I came home through the woods…I caught a glimpse of a woodchuck stealing across my path, and felt a strange thrill of savage delight, and was strongly tempted to seize and devour him raw: not that I was hungry then, except for that wildness which he represented. Once or twice, however, while I lived at the pond, I found myself ranging the woods, like a half-starved hound, with a strange abandonment, seeking some kind of venison which I might devour, and no morsel could have been too savage for me.

And this from Thoreau, the walking classical allusion, who introduces us so genteelly to his "brute neighbors" at Walden. Even the most virtuous, the most civilized, by their inheritance, track mud and blood from the wilderness into the sterile lab, the barnyard, the gaily painted zoo.

There remains the continual temptation, though, to try to opt out of our desires and the metabolic mess, to wash and manicure ourselves and the animals, too, while we're at it. Cleaning up the animals generally means overwhelming our negotiations with them with sheer power—not the kind of power exercised by a carnivore woven into a landscape's ecology, but a power less descriminate, more bludgeon-like. Baudrillard, in fact, describes laboratory biology as a kind of modern Inquisition, an effort to wring from the animals a confession of rationality—rationality being a particular kind of behavioral and anatomical neatness. Often this effort relies on our powerful technologies, like eyedroppers; but often it proceeds

perfectly barehanded. I think sometimes of Darwin pondering the iguanas on the Galápagos by throwing them.

"The usual length of a full-grown one is about a yard, but there are some even four feet long…. Their tails are flattened sideways, and all four feet partially webbed," he begins, the careful, detached observer.

> I threw one several times as far as I could, into a deep pool left by the retiring tide; but it invariably returned in a direct line to the spot where I stood. It swam near the bottom, with a very graceful and rapid movement, and occasionally aided itself over the uneven ground with its feet.... I several times caught this same lizard, [and] nothing would induce it to enter the water; and as often as I threw it in, it returned in the manner above described.

A farcical scene, and rather elemental. A scaled animal warms itself on a rock; a furry animal throws it into the water; the scaled animal crawls back onto the rock; the furry one throws it back into the water; the cycle repeats until the sun swallows up the earth. It's a picture of the life of the world with the center missing—an empty exchange, the wheels of the great metabolism running full tilt with nothing being metabolized. The characters get a glazed look in their eyes and forget what the story is about.

Darwin on the Galápagos, dreaming of animals that make sense and thus throwing the iguanas—dreaming also of birds and tortoises that cared more for him. It isn't just logic that we pursue so ponderously: the dog collar is as potent an instrument as the eyedropper. It recasts relationships in our terms just as thoroughly. But when was the natural world ever without its own logic? When did the animals ever turn their backs on us? Why do we feel we have to grab at them so rudely?

Irenaus Eibl-Eibesfeldt, a biologist, writes that

> [r]hesus monkeys isolated from birth prefer pictures of their own species which are projected onto the walls of their cage to other pictures. They emit contact sounds, invite them to play, and when the projection is switched off they quickly learn how to project these pictures for themselves by pressing a lever.

Raise an intelligent, sensitive animal in pathological conditions and you produce a pathological animal. We are not only the experimenters in this scenario, but also the experimented-upon. Most of us, too, in our own way, have been isolated from birth; and the spectacle of Darwin throwing his iguanas, or me pawing at my alevins, or a doctor removing the claws from an anesthetized housecat, starts to look like scenes from the desperate fantasy life these rhesus monkeys fall into.

Isolated from birth: I'm referring to the estrangement of a culture that hides its bodily negotiations with the animals in the coat closet, forgets there was anything to hide, and then laments that the room has gotten so quiet—an inorganic, rectilinear culture that in its aversion to the real, messy stuff of the world, has taken to projecting images of itself onto every living body in sight—a heady culture that has forgotten almost absolutely how to speak with beings who aren't as heady as it is. I'm speaking, that is, of my own estrangement when I yearn so hard for signs of an inquisitive, friendly mind behind the sparrow's short face, instead of tossing him some seed or just letting him be.

"What have we been doing all these centuries," asks Dillard, "but trying to call God back to the mountain, or, failing that, raise a peep out of anything that isn't us? What is the difference between a cathedral and a physics lab? Are not they both saying: Hello?"

The cathedral and the physics lab: as Shepard notes, our fixations all lead us to the infinitely great and the infinitely small, the cosmic and the subatomic, while pulling our eyes from the burgeoning middle ground, the world of fertile, kicking bodies. We show up at the great dinner party but spend the evening climbing on the chandeliers in search of someone to talk to. We're still aware, dimly, that there are other members of the family out there; we watch the lions and springboks on PBS and stridently save the whales; but these things have become human dramas projected onto other bodies, the glory of battle, the long suffering of the innocent. The bodies' own dramas get lost in the shuffle.

"I fear bodies, I tremble to meet them," cries Thoreau from high on Mt. Ktaadn in Maine. "What is this Titan that has possession of me?" It's as if he woke up from a daydream and found himself wearing someone else's clothes. But bodies aren't clothes, they aren't carrying cases; they're *us.* Who is this "me" he's referring to? He flies on:

> Talk of mysteries! — Think of our life in nature, — daily to be shown matter, to come in contact with it, —rocks, trees, wind on our cheeks! the *solid* earth! the *actual* world! the *common sense! Contact! Contact! Who* are we? *where* are we?

On his way to making this scene, he says he and his companions walked over the "savage and awful, but beautiful" land with "a certain awe, stopping, from time to time, to pick the blueberries which grew there, and had a smart and spicy taste." I like to think that Thoreau was still munching on a handful of blueberries as he stood there crying out for Contact. Bears and sparrows like blueberries too. Let's hear it for food.

Ticks won't spurn us on account of our feelings. I can shrink away from them in revulsion, I can ogle them through an electron microscope, I can work out schemes for keeping them and their diseases off my livestock—it makes no difference, something about me will still smell salivatingly good to a tick. I take this as a glorious, redeeming fact. It says that no estrangement is final: throw an iguana and inexplicably it returns, "graceful and rapid," to your feet, the eternal second chance.

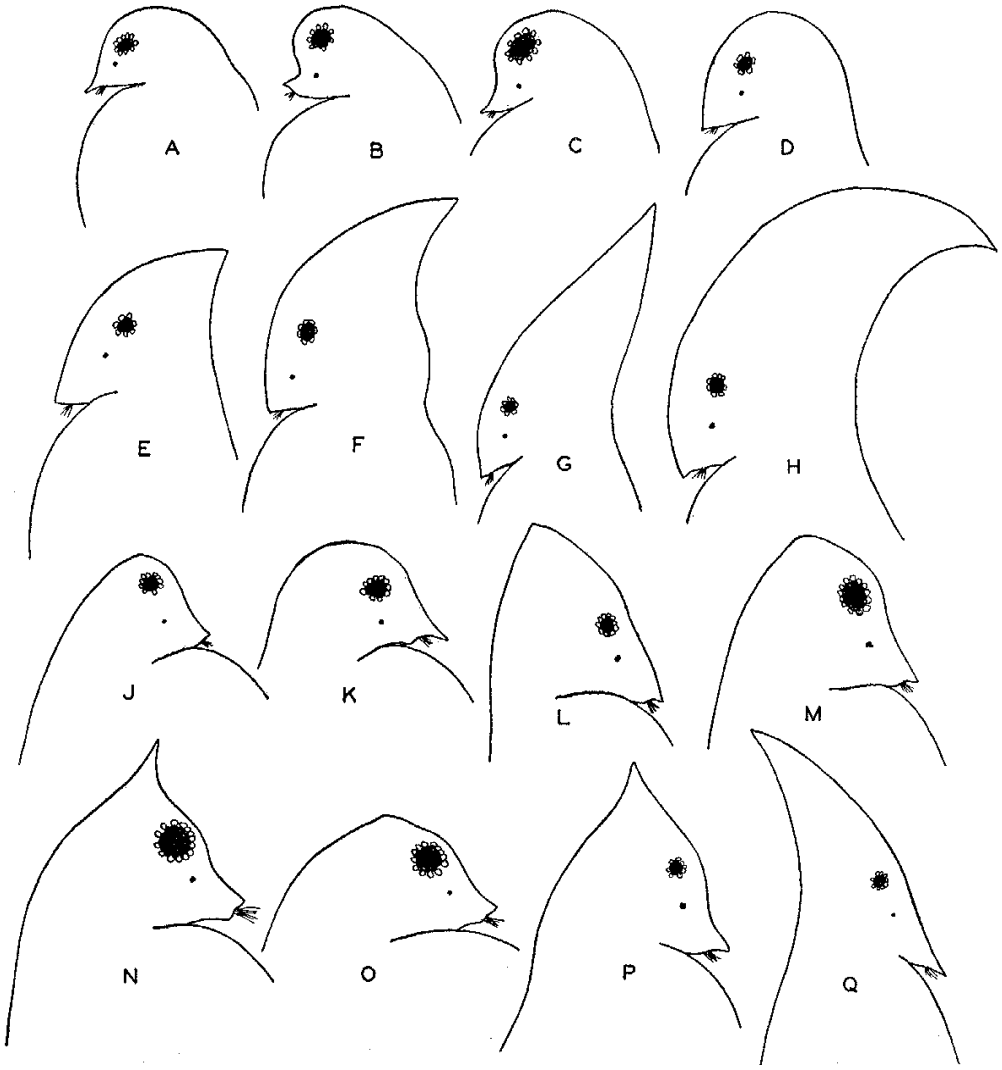
Each of us, each body that hunts and plans and squeals, is a junction point among cycles of exchange. We are upthrust from the earth like mountains, preen and recycle our parts for a while, and finally erode away. A crab grows in its medium, and then at some shock—the sweep of my hand, or a crash onto the rocks from a gull's mouth—its elements disengage, and wander into someone else's tissues. It'll happen to you.

Thus no matter how good we've become at simulating the outsider's perspective, peering at our bodies like we've never seen them before, we're in the thick of the carnival crowd, getting shoved this way and that. What can we do? Stomp off to sulk in the corner with our mechanical toys, as if we've outgrown the tick and the seagull's kind of roughhousing? It is possible to live less insulated than we do. A peasant, said Berger, becomes fond of his pig and then is glad to eat him. James Fernandez, an anthropologist, worked in northern Spain among cattle-keeping villagers who live in quarters directly above their dark, pungent stables. During the day and during the summer, when the cows are out, family life shifts outside as well. At night, Fernandez writes,

> [t]he family is attentive to the signs rising from the dark below: the shifting of weight, the rubbing of a flank against a post, the signs of the laborious bedding down, an unexpected bovine cough or eructation, and even the sound of a new calf suckling. One senses that the family is about as attentive to these nether regions as they are to their own visceral processes….

One villager flings open his stable doors and exclaims, "Ye un paraiso verda!" ("It's a paradise, isn't it!"). It's the oldest paradise, the only Eden that ever existed: the world as digestive system, bulky and warm.

"Above all," Fernandez says, "the cow is a symbol of satiety." The satiety of the cow that sates the human is the method to the carnival's madness: natural violence produces death and round bellies both, in a smooth undulation. Despite appearances, bodily life is never a chaos—and, consequently, never free and easy either. The animals have never wandered, writes Baudrillard. They riot, but with a quiet precision. No wilderness: there is nothing on the earth but circumscribed, well-trammeled territories, the grounds on which we chase each other's tails, and exchange what we exchange.



August

Early in August, on an almost unbearably bright day, I filled a one-quart flask to the top with Roth Pond. I held on to this sample for the remainder of my time in Stony Brook. It contained an entire swarm, perhaps a few hundred strong, of cladocerans, bulbous arthropods the size of large grains of sand, the color of reeds. I had snatched the swarm from the pond with one scoop of the flask. For good measure I had added one of those surface-tension-climbing snails, the size of my little fingernail, brown and amber with dark eyes and a wide pale face like a cow's, and a sprig of the aquatic plant it had been climbing on. The microscope revealed the plant to be hosting a tiny, milky white egg case, of parentage yet unknown.

Outside, everything was turning ancient, as things do in August. The fresh leaves on the trees had all faded by now from bright to dark green like their elders; there were no fresh leaves. The horseshoe crabs at West Meadow had ceased to crawl up the shore. They still arrived in the shallow water from points unknown every evening, but merely hung there, circulating a bit, like meditations. I got the feeling that no novelty was possible anymore, only ten-thousandth recapitulations.

I was improving my technique with the eyedropper. Earlier, whenever I tried to siphon up a copepod, it would detect the inrush of water into the dropper—just the kind of fluid-mechanical signal their senses are attuned to—and jump out of range in time. I practiced being quick, and found myself capturing all but the most alert of them. I told

Jeannette one day. "Congratulations," she said brightly. "You're on your way to becoming a very good fish."

I had been hoping for "marine biologist." But yes, I thought, after a bout with pride, I am becoming a good fish. Granted, if I were suddenly thrown into the Sound in the shape of an alevin, I would probably starve, but the alevins have put in many more hours of practice than I have. Jeannette pointed out to me once how much of the practice of biology relies on becoming attuned to a race of animals through years of caring for them: in her case, collecting copepods, growing algae for them to eat, changing their water, and, too, chasing them around with an eyedropper. Keeping lab animals is a kind of husbandry, and the intuition a scientist cultivates this way is closely akin, I imagine, to the sensitivity of those Spanish villagers to the sounds and odors of their cattle. I think of the animals I've collected and then flung into the bushes when I had extracted what I wanted from them—and I think then of that peasant who loves and eats his pig simultaneously, without contradiction.

Under the microscope, a fat cladoceran was hanging in the center of the field. Its transparent carapace was ridged like gently blown sand and wrapped around it like a cape. Its legs were a blur beneath it, and dark bits suspended in the water around it were inching toward it: the cladoceran was paddling the water in from an incredible radius in a continous flow over its mouth. It was hanging with its mouth and belly toward me—most plankton seem to be indifferent to their attitude in the water—and so I could see its black-edged mandibles gnashing continuously, grinding

up the particles carried by the current before they went down the gullet. The pair of mandibles, I noticed, rocked back and forth at the pace of my heartbeat.

I've come to place great stock in such bodily correspondences. In fact, often it seems to me that they are the sine qua non of my understanding of an animal new to me. All natural history, thought Goethe, starts with sympathy. Count your points of correspondence so that you may then measure out your differences. Paramecia, for example, have supple skin—you can see it when they brush against things. Relax the back of your calf and press on the muscle: that's what a paramecium would feel like, if it were possible to feel a paramecium. Once I saw one rub its flank back and forth on a lump of debris, like a cat. Then it squeezed itself into a hollow in the debris, denting itself more deeply than any self-loving cat would allow, twisting itself into pieces—but no, all was well, it emerged again from the hollow unfazed. This little drama made my day; I was grinning for an hour.

There's nothing finer than these moments when the familiar suddenly somersaults into strangeness: the moments, to put it metaphorically, when the family dog sprouts eight extra legs and a spiky telson. Not that I would want to live in a world of aliens, creatures who never resembled me or my cat; but it's the reversals of my expectations that make life in my natural community seem grounded, like something more than a daydream. A world you know thoroughly is bound to turn out to be a world you made up.

Not that these transformations of the familiar are always pleasant—witness the tick rising out of my shoreline Eden—but I find that they tend to call back to mind just those raw facts I might otherwise kick aside out of laziness. Teale (and remember that Teale was as at home among his local insects as anyone since Fabre) writes that he once "thrashed about in bed for what seemed like hours in the midst of an entomological nightmare," in which

> just as I focused on a Cecropia moth, I saw its back split open and a rumpled green katydid came forth. No sooner had the katydid appeared…than its back opened to let out a brown daddy longlegs which in turn gave forth a striped potato beetle which in turn produced a bright red velvet ant. As the insects came they grew smaller and smaller like the blocks of a nursery set. What the velvet ant would have produced I will never know. For I awoke—

To me this image stands for the looming, horrific side of the world's metabolism: the fact that each little body isn't just what it is, but also a nexus, a summation of seething forces, and will dissolve tomorrow into another little body, another summation just as potent. A striped potato beetle nibbling a leaf won't remain such for long—soon it will have turned into whatever dines on striped potato beetles.

As with individuals, so too with species: the eons roll on and evolution takes a soft-bodied something, grows it a shell, shapes it into a six-foot-long eurypterid with claws like a lobster's, condenses it into a horseshoe crab. Remember that "natural selection" is a euphemism for execution, decimation. The horseshoe crab hangs out in one form for 350 million years; but then what? You can guard the boundaries of your body against invaders, you can lay out the species of the earth in a neat

framework, but these projects are always losing battles. The transformations never stop. Nothing sits still: the lion will never lie down with the lamb, or even pause for a breather.

And yet a striped potato beetle and a horseshoe crab, with all this deadly tumult bound up in their fibers, are such unassuming things. They seem to live in such stark contrast to the harshness of our own behavior. I think of Darwin's description of the armadillos he encountered in the area around Bahia Blanca, in Argentina. He writes that one species, the *pichy*,

> prefers a very dry soil; and the sand-dunes near the coast, where for many months it can never taste water, is its favourite resort: it often tries to escape notice, by squatting close to the ground….It seems almost a pity to kill such nice little animals, for as a Gaucho said, while sharpening his knife on the back of one, "Son tan mansos" (they are so quiet).

So very, very quiet. I should note that apart from the birds and my landlady's cats, none of the animals I met on Long Island ever made a sound in my presence. Copepods dash and tear up their water, to human ears, in perfect silence, just like the ticks as they crawl and suck. These animals don't even cry out when I sharpen my knife, so to speak, on their backs.

The animals bob in the water, perfectly silent, perfectly contained—yet at the same time discoursing theatrically on the minutiae of their livelihoods, and the hungry currents in which we all swim. There's an arresting discontinuity in their self-presentation, something akin to the "sound of sheer silence" that speaks to Elijah at Horeb after howling winds

and earthquakes and fires have prefaced it. Or, to switch theologies, something akin to what comes out of the mouth of the baby Krishna in a certain North Indian story.

Krishna (the audience knows) is an incarnation of Vishnu, the supreme deity, but he's been born to a simple cow-herding family, who only know him as a mischievous toddler. One day Krishna is playing with a friend outside and eats some clay from the ground. Someone tattles and Krishna's mother comes on the scene, most stern; he protests his innocence. She insists on looking inside his mouth; he opens it. Inside she sees the entire universe, the heavens and the hells, great seas churning, worlds careening, and just about keels over, dumbfounded. Then Krishna shuts his mouth again, and that's the end of that: he goes home with his mother.

Isn't every striped potato beetle, every alevin darting after a meal, like the Krishna of this story? Each organism just slaps about in the mud, in its own fashion, but when you get up close and make it open its mouth, you're bowled over. Another resemblance: a living creature munches up the clay in the ground, and as it chews it metabolizes the earth into new bodies, its own and its children's, boundless masses of cells and tissues and offspring. It leaves an intricate pocket of order, a cosmos, where you wouldn't expect to find one. This makes for as good a definition of life as any. Life is what creates universes by chewing up clay.

These were the images—Teale and his infinitely unfolding insects, Darwin and companions sharpening knives on armadillos, Krishna and

his baby cosmos—I had in my head when I noticed, three days after collecting my sample from Roth Pond, that some of the cladocerans were pregnant.

There were two generations in the swarm, I discovered, some little, some big, and the big ones were carrying clusters of four or five eggs on their backs under their carapaces. I had read that cladocerans in wholesome environments may produce an entire new generation every few weeks. The big ones were, in fact, very pregnant: the embryos hunched inside their eggs looked almost fully formed, their eyespots dark, their own carapaces pointed at the tail and parted slightly over the belly, like their mothers'. In each female the embryos hung at all angles, packed close, quiescent until one twitched and the whole brood sprang awake, jostling each other vigorously. They seemed to quiver with pent-up energy, a tremendous impulse to break out of their chamber and start living in earnest. The lab around me was almost black, their magnified image was bright and awesomely clear, and I forgot all context. I was seeing nothing anywhere but them.

One pregnant female had grown hugely distended, almost two millimeters long, a dozen embryos squirming on her back. I chased her around the petri dish with the eyedropper, transfixed. I suddenly envisioned the maturation of these embryos within their great mother and the appearance on their own backs of a new cohort of eggs, growing, sucking up food, reiterating the cycle. A year of generations—two years, a century—all nested within this one tiny body, its armor so thin it barely

clouded the microscope light streaming through it. I don't know what I would have done if I had wrecked her with the lip of the eyedropper, which wouldn't have been hard to do.

I transferred her safely into a droplet about twice her size and waited for her to settle down so I could get a really good look. She didn't settle down. If the edge of the water hadn't been so flexible she would have banged herself silly trying to escape from her prison. She flew hard from wall to wall in all directions, slowing not a bit, her embryos jangling inside her. I felt a bit sick. Finally I lost the nerve for this exercise and I returned her to the flask, where she slowed to normal cladoceran speed immediately. My heart was pounding. She was such a small bit of stuff; this entire swarm in the flask, in fact, such a trifle; but my ability to be dismissive of living trifles had foundered.

I had brought home no isolated sample, it occurred to me, but a corner of a juggernaut so tall I couldn't see to its top, something that throbbed with energy and beat on all the walls I threw up in its path. The flask might as well have held a thousand miles of rainforest, and I might as well have been a noisy fly biting the inhabitants at random. Scooping that swarm from its pond suddenly seemed like chipping at the heavenly throne with an ice pick. I stared at these pinpoints in the cloudy water of the flask, each with its boundless capacity for reproduction and assimilation, and I was, I realized with astonishment, afraid. But then the moment passed, my passion faded, and the big cladoceran returned to

being just a big cladoceran. I cleaned up the lab a bit and then looked back at it. It wobbled through the water like a bread crumb.

A mouth opens, and shuts again. There's nothing mystical about it: just an awesomely complicated world, and a patchwork kind of brain trying to look inside. The world I inhabit swells and shrinks, as the generosity of my thoughts flows and then ebbs again.

That egg case on the snippet of plant, by the way, turned out to be hosting snails. Over several days they took form, developing outlines and postures, their shells hardening on their backs and blushing into color. They rotated slowly inside their perfectly spherical eggs, island universes. Their ink-black eyes looked out directly, like a human embryo's. Actually, the resemblance was unsettling. I looked like this once. There was a time early in my own life when I, like these snails, hung perfectly still with my heart beating softly, given over to enormous propulsive rhythms, waiting boundlessly.

And even now, many years out of the womb, when you and I have grown so complicated and so many voices clamor at once, there's a quiet tide that rises behind us, a substrate for our lives. It is there, always, even when it's the last thing on one's mind. I may flit through the rough-and-tumble world like a spirit, cogitating and building machines, swinging between friendly and hostile apparitions, searching after this and that, but there is a larger world, it is solid and moving, and all disconnections from it are imagined. From time to time, when my own activity falls silent, I

hear my own heartbeat; the synchronous rocking of mandibles digesting food; and the sheer silence of the waiting of the snails.

Ten weeks after I disturbed that mating pair so baldly, the horseshoes at West Meadow and I had come to a kind of working agreement: I knew what distance I had to keep and what I didn't. (You can swim as close to a horseshoe crab as you want, you can even tap it with your nose if you like, it won't care; but you're responsible for getting your own toes out of the way when it scuttles by.) I knew how they chewed their prey—by walking over it, letting the thorny bristles on the insides of their legs grind up the shells—and I knew what time of evening they'd appear by the shoreline.

But something crucial wouldn't stick. One day I'd feel perfectly at home beside them, and the next they'd look like alien contrivances. One day the surface of the water would shift gently and I'd sway along with it; the next day I'd shiver on shore while the water rippled abstractly, like an equation too hard to solve. I'd return to the lab: a cladoceran bends an appendage it has never bent before in an unfathomable maneuver, and then darts out of view. Back to the beach: an army of inch-long hermit crabs appears out of nowhere, scuffles for an evening, and never returns. Beach to lab, to beach, to lab: I stop here and I stop there, as Fabre said, putting questions, and waiting till the cows come home for those scraps of a reply. I'm listening—or at least I think I'm listening—but the animals

aren't talking, just conking me with peanuts.

I would stand at West Meadow sometimes and look around at the lives being led as if this were some alien planet, as if I hadn't already spent two billion years here: I would come down with total amnesia. Where did my memory run off to? Once there was a day in Eden, so the story goes, when the human turned to each animal and called it by its true name. Now I can't even figure out the genus of one snail with an enormous Guide to Freshwater Invertebrates in front of me. But somewhere, locked up in the landscape and in our own bodies, is the story of our ancestry: the explanation of how we got from *there* (I'm pointing at some slime on the rocks) to *here.*

Locked up beside it is the great ledger that records all our metabolic transactions: century after century of wild entries that somehow, on the bottom line, sum not to chaos and crashes and bleak, empty rocks, but to food to eat and trees to sleep under. It's an enormous, complicated story. It's awfully easy, though, to get so caught up in the entries of the human ledger that one forgets the hard realities of the larger economy: the convoluted processes by which the little things—the pond snails, the copepods, and all the rest—end up being so fundamental to everything we know. Human matters are often so noisy that the only natural phenomena that can get a word in edgewise are the bigger ones, the particularly flashy ones, the ones that do tricks, like (to pick a convenient example) beavers.

Beavers are the subject of today's discourse by Georges, Count Buffon, eminent zoologist of the late eighteenth century; he is digressing for a moment to lament the vanishing of the animal world. "[C]onquered and turned into slaves, or treated as rebels and scattered by force.... What visions and plans can these soulless slaves have, these relics of the past without power?" he asks. "...Only vestiges of their once marvellous industry remain, in far deserted places, unknown to man for centuries." He adds that "beavers are perhaps the only remaining example, the last monument to that animal intelligence."

The scenario is familiar enough: humans come on the scene, and the animals exit stage right. Poor animals. Note that this sentiment arose even before the railroad, the horseless carriage, the manureless fertilizer, during a time when animals were still utterly essential to even the most technologized human economy. Our civilization was developing the impression that the animals were disappearing centuries before we started taking rooms thirty stories above the ground and eating bean curd instead of salting away our own pork.

Buffon's tone is gentle, nostalgic, and dramatic. Modern documentaries on endangered species follow in kind: Cousteau, for example, was a master at creating this mood, giving us glimpses of a mysterious world about to succumb, after so many eons, to overfishing or some such human power. There's an undercurrent of self-satisfaction to such eulogies. We're in charge, they say: we've replaced the animals' rules with our own, and we have the luxury of mourning their deaths rather

than having to watch out for tigers. But isn't it a shame we're on top of the world?

"Let us make humankind in our image, after our likeness," says God on the sixth day of creation, "and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth." Dominion is just a step away from disconnection, in which we dispatch the soulless slaves Buffon spoke of to the margins of the earth and have the place to ourselves. Our dominion isn't going as well as planned, though. Granted, we've done pretty well with the fish, the cattle, and some of the wild animals, but the creeping things—and there are a lot of them—are being more elusive. They aren't waving our banners quite yet. In fact, "[s]o important are insects and other land-dwelling arthropods that if all were to disappear, humanity probably could not last more than a few months," writes E. O. Wilson.

> Most of the amphibians, reptiles, birds, and mammals would crash to extinction about the same time.…The land surface would literally rot…The land would return to approximately its condition in early Paleozoic times, covered by mats of recumbent wind-pollinated vegetation, sprinkled with clumps of small trees and bushes here and there, largely devoid of animal life.

Someone ought to tell the ticks that the land is ours now, not theirs, or tell the raccoons who delight in our garbage cans that there's no room left for their marvellous industry, and that they're relics of the past. Buffon and the rest tell tales as if the animals are disappearing from the earth, when in fact they're only disappearing from our awareness. We

extinguish the big, fragile species and think hamburgers come from the supermarket. Hamburgers don't even come from ranchers; they ultimately come from an epic invertebrate extravaganza under the soil. We can't even identify the full cast, let alone follow the plot.

It's a big world out there. There are, at last count, about one and a half million species on the stage, and those are just the characters whom scientists have given names. As far as I can tell—and I spent my whole summer on Long Island looking—the names have never all been compiled in one place. They change too fast, for one thing, as researchers reconsider the genealogy of odd species.

In books you can find charts that give overviews of the family tree—the five kingdoms of organisms, the phyla into which they are divided, perhaps the next level or two of subdivision—and charts of the tips of the branches: all the species, say, in one family of one order of the subclass *Copepoda* of the class *Crustacea* of the phylum *Arthropoda*. And there are charts that cover a midrange, like the guide to families of North American freshwater invertebrates I referred to all summer, which despite its partialness weighed many pounds. But there's no complete list of species anywhere. I've become enthralled by the idea of seeing the entire assortment of known creatures, the entire Taxonomia, in one place. For that matter, I've become enthralled by taxonomy, period. Certainly there's a reducing, flattening tendency to it—it tends to pin down and lay out the most dazzling array of organisms like a model line in a factory showroom. But taxonomy, when you hold it right, turns into the key to the kingdom.

It lets you into the showroom through the back door so you can play all night in the aisles, staring into face after face after face.

Annie Dillard stands at night in a meadow, and a grasshopper lands on her shoulder. "Why didn't God let the animals in Eden name the man," she asks later; "why didn't I wrestle the grasshopper on my shoulder and pin him down till he called my name?"

I turn to taxonomy as a way of letting the grasshoppers and their kin jog my memory, letting them snap me out of my amnesia. To this end, I propose an exercise. It's straightforward in everything but the logistics.

First—this is the easy part—let us finally compile the entire Taxonomia in one place. No description: just the one and a half million names. I figure they will fill about forty volumes. Second, let us build a new set of cathedrals, preferably of wood or sod, where we can gather on Sundays for a new kind of Latin Mass, in which we chant the names start to finish, week after week, like a synagogue congregation progressing through the Torah over the course of a year. Only we can't finish in a year.

We'll start with the big, new animals and work our way down into the soil. First come the whales, order *Cetacea*, recently evolved, and as I figure it by the next week we've already passed ourselves by and are on to the small mammals. One year later, we close out subphylum *Vertebrata,* savoring the name of one of the smaller fishes on our lips; a few more names and we complete our phylum, *Chordata,* and return the first volume to the shelf. The next phylum, *Arthropoda*, fills volumes two

through twenty-four.

The children born the week we enter the arthropods grow up chanting the names of the insects: after each service teachers can take them aside to tell them stories about the striped potato beetle or the katydids born coral pink, as is appropriate. As these children reach adulthood, it will be time to move on to the crustaceans:

Simocephalus vetulus,
Simocephalus exspinosus,
Simocephalus serrulatus;
Daphnia magna,
Daphnia longispina,
Daphnia pulex;

—Thus is order *Cladocera* revealed one week during this period, before vanishing back into the legions of names passing through us.

We chant through the remainder of the animals, the plants, the fungi, the protozoans, the algae, and finally the bacteria, kingdom *Monera*, so few of whom have ever been seen—our voices hush to whispers by the end as we think of these legions of unfathomable lives. Thirty-seven years have passed. But we aren't done: I hear estimates that unknown species outnumber the known several dozen to one. So, for completeness, we sit together in silence every Sunday for another 1300 years, our thoughts given to all the relatives we have never met.

When our descendants emerge from their last convocation, late on a sunny afternoon, and a grasshopper lands on someone's shoulder—what then? They will have measured the true size of the earth, and they can look in the mirror, as we can, to see their own size. Might they finally

turn to the fish of the sea and the birds of the air and every creeping thing that creeps upon the earth, strip themselves bare, and cry out, "*What is our name?*"

You can only ask such a question—if you expect to get an answer—from a state of pure vulnerability, ready to accept whatever answer is given no matter how much blood it draws. I imagine that nature, sincere as it is, will give one that draws quite a lot. Will our kind be ready in 1300 years, or will it take another run through the Taxonomia from the top? There's time; the animals will wait. What's 1300 years? Nothing, a blip. We've been painting horses on the cave walls a hundred times as long. All the same, couldn't we speed things along by spending more days now prostrate before the dens of the wolf-spiders?

I'm enthralled by taxonomy because it provides such unexpected, and complete, context. It turns out that you and I are more closely related to vampire bats than to golden retrievers: who would have thought? We are linked by our Latin names into expanding circles of relationships, just as we are linked by the tastiness of our blood into the material cycles of the food chain. Our taxonomy is not an abstraction: the relationships of the taxa reflect and distill all of life's evolution and genealogy. Our names are markers in a two-billion-year genetic story.

There's an enormous horseshoe crab shed in the sand in front of me. It's big enough that it must be from a female, an old one. She, like all the horseshoes on the North American East Coast, belongs to the species

polyphemus of the genus *Limulus,* of which only the one species has survived. Two other genuses, comprising three species, live today in the coastal waters of Asia. Thus four species of horseshoe crab are all that remains of the ancient subclass *Xiphosura.* A subclass can be quite large. All the placental mammals, from a field mouse to an elk, fit in one subclass. Every other member of *Xiphosura* has either fossilized or been forgotten entirely. The four surviving horseshoe crab species inhabit their looming taxonomic spaces like old men in an empty concert hall.

But at higher levels of organization, their kinships blossom forth. They join the subphylum *Chelicerata* along with spiders, ticks, mites, scorpions, and a few others. Look right above the mouths of any of these creatures—you can use your fingers or an electron microscope, as is appropriate—and you will find a pair of two-jointed feeding appendages called chelicerae. It's a defining characteristic. In the same way, you or I can be pegged immediately as mammals by the hair on our bodies, and as primates by the fingernails we have in place of claws. All of us creatures bear our genealogy in our flesh: it is inscribed on us, like totemic tattoos.

Continue climbing the levels: horseshoe crabs are arthropods, like the sand fleas who wander over their sheds, and animals, like the shorebirds who dig up and feast on their eggs. Past this, our classifications—I say "our" because we and the horseshoes share the rest—are matters of cellular architecture and biochemistry. For example, I am a eukaryote, like cauliflower, but unlike the *E. coli* bacteria in my gut that help me digest it. Finally, a broad but essential classification: the horseshoe

crabs, the *E. coli* and I are all living beings, as opposed to being clay.

The old female horseshoe whose discarded skeleton I'm holding and I parted genetic company five or six hundred million years ago, when the animal phyla were first being differentiated. It's a cloudy period, the fossil record from the time spotty and confusing. But think of what we do know: sometime during that period, somewhere in the world ocean, there lived a tiny oxygen-breathing matriarch whose progeny includes me, you, the terns, the ticks, the striped potato beetles, and this wizened old horseshoe crab. She was a matriarch like Sarah; her children Isaac, father of the vertebrates, and Ishmael, father of the arthropods. Six hundred million years: not so long, in the long view.

Let's pretend that the morning I left Stony Brook, instead of tossing that great mother cladoceran and the rest of her flask down the drain, I took her back to her pond and gently released her. Now let's give her six hundred million years to raise a family. Into what twelve tribes will her dozen eggs grow? What new Taxonomia will the descendants of the wolf-spiders chant in their great dens, once they've achieved sentience and a high standard of living and start to feel alone in the universe, estranged from the tall, hairy, fingernailed critters scurrying about their ancient suburbs?

But the question is moot: the cladoceran did go down the drain of the sink, and I scrubbed the algae out of her flask till the plastic squeaked. But an alevin could have finished her off just as easily. There are tremendous forces loose in the world, and like any creature that hunts and

searches, like any metabolizing bit of matter, we shoot them off in all directions.

In the end, perhaps, there's nothing to do but enumerate correspondences, and allow the crises of identity that won't be solved simply to dissipate. It's the small correspondences, says Barry Lopez, that bind a landscape together. The horseshoe crab shed in my hands is encrusted with barnacles and sea slippers, like the rocks, like the snail shell which, when magnified, turns into a twisting prairie on which glistening protozoans root. It's turning dusky; I set down the shed and pad across the wet sand. A periwinkle is making its way along the edge of a tidepool, its foot flexing gentle and muscular like the surface of the water. The hind end of its foot bears intricate tracings, like an unreadable script, like the text of books.

I slosh into the water, bracing and relaxing as I go with each cold high-tide line written on me. The human body, I hear, is three-quarters saltwater, just like the surface of the earth. I stand very still, shivering. The hairs on my arm are swaying with the current like the kelp; my ape fingernails are turning the same violet-blue as the fading sky. Something wriggles intently under the ball of my foot. Out somewhere in front of me, invisibly, the horseshoes are migrating back out into the deep blue sea.

Key to Illustrations

cover Three copepods of different species, magnified a few dozen times. "U" and "M" identify the main sections of the body, the urosome and metasome. The female on the left is carrying masses of eggs on her urosome (Pennak, p. 384.)

June Three methods by which a horseshoe crab flipped and stranded by waves may right itself. Since a horseshoe crab's legs don't extend past the edge of its carapace, this requires some maneuvering. The original caption reads,

> Horseshoe crabs that overturn on breeding beaches use their telsons to right themselves by (a) bending dorsally…and rolling over, or (b) by driving their telson further into the [sand] and sitting up. (c) If a crab does not right itself, an alternative method is to fold ventrally into a 'doubled-up' position and wait for the next inundating high tide. This behaviour apparently minimizes desication and offers protection from gulls that frequently attack overturned crabs, pecking and tearing at their gills, appendages, and telson muscles….

(Figure modified from Penn and Brockmann, p. 1535.)

July *Top:* the mouthparts of the tick *Boophilus microplus* (Sonenshine, Vol. 1, p. 120). The presence of cheliceral digits (labeled "Ch. d.") reveals the evolutionary link between ticks, horseshoe crabs, and spiders.
Bottom: the life cycle of the winter tick in Alberta, Canada (Sonenshine, Vol. 2, p. 19). The winter tick belongs to the genus *Dermacentor* along with the American dog tick, a species with which I have some familiarity.

August The heads of some cladocerans. Just two species account for all these variations: A-H are varieties of *Daphnia pulex,* and J-P varieties of *Daphnia longispina.* In general, cladoceran head shape changes gradually from generation to generation, in a year-long cycle: the young are born helmeted during the summer and round-headed during the winter. As pond water heats up during the summer, it decreases in viscosity, and so helmetless cladocerans would find themselves tending to sink away from the algae they eat, which grows thickest in the sunlit top layers of the water. The helmets increase the cladocerans' surface area, and therefore their buoyancy, so that they can hang where they want to in the water without sinking too fast. Some cladocerans also develop higher helmets or defensive spikes in the presence of predators (Thorp and Covich, p. 727). Figure from Pennak, p. 360.

Notes

June

4 **Annie Dillard:** "Life on the Rocks: The Galápagos," *Teaching a Stone to Talk*, p. 109.

6- **horseshoe crab migration and mating:** Sargent, pp. 21-22, 42-43.

8- **350 million years:** This somewhat arbitrary figure was drawn from Sargent, p. 24. (The state of the continents at the time is mapped in Gould, *Book of Life*, p. 27.) Other figures I've seen for the age of horseshoe crabs range from 200 to 500 million years. The ambiguity lies in defining "horseshoe crabs," since they evolved smoothly from creatures that were not them.

A further complication: the species that roams the American East Coast today, *Limulus polyphemus,* evolved so recently that it has no fossil record at all, and the genus *Limulus* only dates back 20 million years, no farther than our own order of hominoid primates (Gould, *Wonderful Life*, p. 43n). But since modern species (there are three others in Asia) are morphologically similar to older ones, it seems appropriate to include a long span of species under the name "horseshoe crabs."

9 **will try to mate with anything:** Sargent, p. 117.

11 **katydids:** Teale, pp. 205, 208.

fall too neatly into place: As E. O. Wilson has observed, even as we seek resolution to the mysteries before us, we intuitively seek out new mysteries (*Biophilia,*p. 10).

12 **horseshoe crab's eight other eyes:** This number is also somewhat indeterminate, since there's an ambiguity in how developed a photoreceptor has to be in order to be considered an eye.

15 **"All cats are ornithologists":** William T. Davis, the Cicada Man of Staten Island, quoted by Teale, p. 106.

housecat and half-dead mouse: This kind of predatory play isn't uncommon among animals. Even robber flies do it: Teale once saw one playing with a small bee it had captured (p. 138).

16 **wolf-spider den:** Burroughs, "The Art of Seeing Things," *Birch Browsings,* p. 127.

17 **seeds on a cattail:** Teale, pp. 40-41.

Fabre: pp. 2-4.

18 **adopted family:** Consider, as another example, Gavin Maxwell describing his attachment to Mijbil, a marsh otter he brought home to his cabin on the Scottish coast from Saudi Arabia. (Maxwell notes that otters do not make pets in the sense one usually thinks of: "when one plays ball with an otter…it is the otter who throws the ball—to a remarkable distance—and the human who fetches it" (p. 125)). Mijbil belonged to a

subspecies unknown to science until Maxwell brought him to England, and which was thus dubbed *Lutrogale perspicillata maxwelli*. He writes that Mijbil behaved toward him and two close friends "as Mediterranean people do toward their [Trinity], with a mixture of trust and abuse, passion and irritation. In turn each of us depended, as gods do, upon his worship; I, perhaps, most of all, because he belonged to the only race of living creature that was ever likely to bear my name" (p. 140).

19 **White's biography:** Worster, pp. 4-11.

ring-ousels: White, p. 64.

hedgehog: White, p. 73.

"parochial history": White, p. 3.

"The matter of food…": White, p. 128.

"When owls fly…": White, p. 145.

19- **house-martins:** White, pp. 148-49.

20 **British expatriates:** Mabey, p. viii.

"Nature comes home…": The passage continues,

> One's own landscape comes in time to be a sort of outlying part of himself….The home feeling, this domestication of nature, is important to the observer. This is the bird-lime with which he catches the bird; this is the private door that admits him behind the scenes. This is one source of Gilbert White's charm, and of the charm of Thoreau's "Walden."

(Burroughs, "A Sharp Lookout," *A Sharp Lookout*, pp. 331-32.)

20- **field mouse in the flower pot:** Eisley, "The Brown Wasps," *The Night Country*, pp. 227-30.

22 **economic language in ecology:** Worster, chapter 14.

bandsawed into chunks: Horton, pp. 77-79.

biomedical research: Sargent discusses research applications of horseshoe crabs extensively.

23 **"empire of meaning":**

> What is essential is that nothing escape the empire of meaning, the sharing of meaning. Certainly, behind all that, nothing speaks to us, neither the mad, nor the dead, nor children, nor savages, and fundamentally we know nothing of them, but what is essential is that Reason save face, and that everything escape silence.

(Baudrillard, p. 137.)

"unexpected reciprocity": Baudrillard, p. 134.

"inevitability of death": Baudrillard, p. 131.

24 **Lester Ward:** Worster, p. 175.

25 **Brian Goodwin:** Blakeslee, p. C8.

Dinah the praying mantis:

> Established on a plant in my study at home, Dinah watched me curiously, her great-eyed, pointed head turning this way and that to follow my movements.…She would study me intently for minutes at a time with her head cocked on one side

> like a puppy. On other occasions, she would come close with her threadlike, exploratory antennae—endlessly in motion—stretched far in my direction. Once I looked up and caught Dinah facing me from the top of a letter file, standing motionless with one foreleg lifted and curved backward as though she were a hunting dog on point.

(Teale, p. 213.)

making and growing: Shepard, pp. 282-83.

Disney: Shepard, pp. 279-82.

26 **chopped liver:** As Mary Midgley writes, "engineers are usually viewed as being more important than the things they engineer" (*Beast and Man*, p. 89).

"the starting-point of a daydream": Berger, "Vanishing Animals," p. 665.

Navajo Coyote stories: Shepard, p. 93.

flesh-and-blood coyotes: Midgley considers the simultaneous moral condemnation of animals and the dismissal of them as mechanical in *Beast and Man,* pp. 25-36.

Shepard devotes a chapter to scrutiny of the language of the animal rights movement (chapter 23). He objects to the overextension of an ethic that applies realistically only to "the management of enslaved animals"— "as though all life were kittens abandoned on the street." The desire to see all pain ended everywhere, he says, is "a neurotic zeal that omits all of 'nature' except the individual—the projected self as it searches for terms of responsibility, justice, and affiliation in animal welfare" (307, 315).

26- **medieval animal trials:** Beach, pp. 49-51.

28 **"…the epithets barren and sterile":** Darwin, p. 353.

28- **Darwin 's observations on the Galápagos:** Worster, pp. 119-20.

account of Chatham Island: Darwin, pp. 378-79.

29 **"a universal metabolism":** Shepard, p. 241.

31 **Arctic muskoxen:** Lopez, *Arctic Dreams,* p. 75.

air for a gliding hawk: Russell, p. 199.

32 **"The buffalo grazing quietly…":** Shepard, p. 241.

July

36 **"Nature is inhumanly sincere":** Lueders, p. 49.

37 **red in tooth and claw:** Says Worster, "Alfred Tennyson's 'Nature, red in tooth and claw' was practically a cliché even before he uttered it" (p. 127).

39 **"The rum brings the tick…":** Harrison, p. 35.

40 **TV wildlife specials:** For a longer consideration of TV nature programming, see the chapter named "Noonday" in McKibben.

lions, springboks, and Romantics: Writes Worster,

> While some, like Thoreau, were…giving fresh relevance to arcadian paganism, others came to find that natural joy too tame and to take an increasingly decadent interest in the fearful and demonic forces around them.…[T]o be at one with the world, for them, was to embrace all the tumult, horror, and darkness in it, to commit oneself to struggle and defiance.
>
> But the trick in this quest for dark, fearful adventure was to keep alive an exuberant acceptance of the nature thereby discovered…roaring lions leaping onto the backs of paralyzed stallions, dreadful torrents plunging over cliffs, thundering volcanoes erupting into lurid skies. How much of such horrors could a healthy attitude toward nature withstand, especially in people historically inclined toward suspicion of nature anyway? (pp. 125-26)

By the Victorian era, the tension the late Romantics maintained between abhorrence and acceptance had collapsed under the weight of these images, and estrangement from nature became a point of virtue.

Traditionally, animal behavior research has operated in the Victorian mode, its emotional undercurrent neither arcadian contentment nor Romantic relish, but rather condescension and distaste for the creatures and phenomena studied. Midgley writes, "People seem to believe, first, that science ought not to be guided by emotion, and secondly, that whereas love and admiration are emotions, disgust and contempt are not" ("Beasts, Brutes, and Monsters," p. 44). My experience is that this attitude is moderating today, at the same time as researchers pay increased attention to the natural context of behavior, rather than trying to isolate behavior in the lab.

holiday barbeques: Gary Snyder writes, "Our bodies—or the energy they represent—are…continually being passed around. We are all guests at the feast, and we are also the meal! All of biological nature can be seen as an enormous puja, a ceremony of offering and sharing" ("A Village Council of All Beings," pp. 76-77).

41 **"I shake the mug…":** Harrison, p. 34.

42 **"A peasant becomes fond of his pig…":** Berger , "Animals as Metaphor," p. 594.

economic ecology hinting: The standard model of an ecosytem as a web of producers and consumers does indeed suggest a cooperative system in which making and unmaking are balanced. But the metaphor also entails a distance between the producer and the thing produced that does not exist. The biological economy is total, much more immediate. When a factory produces a VCR and I consume it, the factory hums along, making some money. When a spinach plant or a hen produces itself and I consume it, no more spinach plant or hen.

42- **"…almost that of a housefly":** Dillard, *Tinker Creek,* p. 128.

43 **five feet above the ground:** My father pointed out once that even a bird's-eye view is, quite often, just a few inches above the soil. There are far more robins and crows and other ground-feeders in the world than hawks.

45 **rotating paramecia:** This rotation is common in little creatures that have no eyes or ears but do have the ability to rotate: it's a means of maintaining a straight course over a long distance. All animals suffer from inherent biases in their locomotion, and without external cues quickly veer off course. (Try, for example, closing your eyes, sticking your fingers in your ears, and walking straight ahead for more than ten yards or so.) Swimming in circles is a rather inefficient way to search for food, and so paramecia rotate as they go in order to aim their bias in all directions equally and thus cancel it out. (Dusenberry, p. 386).

45n **Berger:** "Why Zoos Disappoint," p. 123.

46 **"As it swims and hovers…":** Yen and Strickler, p. 171.

47 **Burroughs and the chipmunk:** "In Field and Wood,"*Birch Browsings,* pp. 174-75.

48 **negotiations with animals:** The most fundamental, perhaps, of these negotiations is that between human hunters and their prey, which has been running continuously for a very long time indeed. "Years ago I would have eaten meat brought to bay by dogs," writes Barry Lopez. "Now I take the meat straight across or not at all. Each year these contracts with game animals are renewed, rewritten" (Lopez, "Trying the Land," *Crossing Open Ground*, p. 56).

50 **Thoreau and the woodchuck:** *Walden*, p. 142-43.
"brute neighbors": *Walden,* chapter 12.

51 **"The usual length of…":** Darwin, p. 390.
"I threw one several times…": The passage continues, "Perhaps this singular piece of apparent stupidity may be accounted for by the circumstance, that this reptile has no enemy whatever on shore, whereas at sea it must often fall a prey to the numerous sharks" (Darwin, pp. 391-92).

52 **Eibl-Eibesfeldt and the rhesus monkeys:** Midgley, *Beast and Man*, p. 311.
"What have we been doing…": Dillard, "Teaching a Stone to Talk," *Teaching a Stone to Talk*, p. 89.

53 **infinitely great and infinitely small:** Shepard, p. 82-83.
Thoreau on Ktaadn: *Maine Woods*, pp. 92-93.

54- **Spanish cattle-herders:** Fernandez, pp. 228-29.

August

61 **Goethe, sympathy in natural history:** The Goethean approach assumes a perfect correspondence between the inner human world and the outer natural world: the place to start is with what one knows of oneself. The idea of anthropomorphism becomes a tautology (Worster, p. 89).

This kind of sympathy is one path—an awfully common one, actually—to becoming

attuned to an animal the way a researcher is to her subjects, or a hunter to his prey. Field biologist D. L. Cheney and his co-authors have written that, philosophical debates aside, "anthropomorphizing *works*": it's "often the best way for an observer to predict what an individual is likely to do next" (Kennedy, p. 88).

62 **kick aside facts out of laziness:** Dillard writes, "I don't really look forward to [my] microscopic forays;…I do it as a moral exercise; the microscope at my forehead is a kind of phylactery, a constant reminder of the facts of creation that I would just as soon forget" (*Tinker Creek,* p. 121).

Teale's nightmare: Teale, p. 159.

natural selection as decimation: Evolutionary history is usually depicted as a smooth process of growth and expansion. Gould shows, however, in his discussion in *Wonderful Life* of the ancient Burgess Shale fossil beds, that at least by some standards, animal life was far more diverse immediately after its inception than today. In his model, massive extinctions like the one that killed the dinosaurs aren't disturbances of the normal evolutionary process; they are the normal evolutionary process.

"I have struggled over a proper name for this phenomenon of massive elimination from an initial set of forms, with concentration of all future history into a few surviving lineages," he writes. He settles on "decimation," to capture both "the largely random sources of survival or death, and the high overall probability of extinction" (*Wonderful Life*, 47n). This is a far cry from the march-of-progress model of evolution that was dominant among scientists from Victorian days until just a few decades ago, and remains the dominant popular view. (See Chapter 1 of *Wonderful Life,* "The Iconography of an Expectation.")

63 **Darwin, the Gaucho, and the armadillo:** Darwin, pp. 102-3.

silence of the copepods: In a stricter sense, every animal that moves in water produces sound, that is, mechanical vibrations. A copepod producing a feeding current paddles its legs at about fifty cycles per second; if these vibrations could be amplified into the range of human hearing, they would sound something like a cat purring.

63- **Elijah at Horeb:** 1 Kings 19:11-13.

64 **Krishna:** Coomaraswamy and Nivedita, p. 223. I'm editorializing a bit: their telling isn't so dramatic.

69 **alien planet:** Shepard discusses the link between science-fiction aliens, the search for UFOs, and ecological alienation (p. 146).

naming the animals in Eden: Genesis 2:19-20.

70 **Georges, Count Buffon:** Berger, "Vanishing Animals," p. 664.

71 **"Let us make humankind…":** Genesis 1:26.

"So important are insects…": Wilson, *The Diversity of Life,* p. 133.

72 **one and a half million species:** Here's the breakdown, adapted from the results of a study by E. O. Wilson:

Kingdom Animalia:	1,032,000
Kingdom Plantae:	248,000
Kingdom Protista:	57,700
Kingdom Fungi:	69,000
Kingdom Monera:	4,800
total:	1,412,000

Fully half of that total consists of insects. Twenty percent consists of beetles alone (Wilson, *The Diversity of Life,* pp. 134-36).

The vertebrates (mammals, birds, reptiles, amphibians, and fish) add up to only three percent of the total, despite the fact that almost every nature program ever produced has been about them. Like those rhesus monkeys Eibl-Eibesfeldt described, we prefer pictures of our own kind projected on the walls of our cage to other pictures.

73 **Dillard and the grasshopper:** Dillard, *Tinker Creek,* p. 220.

73- **chanting the Taxonomia:** I think an hour a week of chanting is appropriate: that leaves time for personal testimony about the week's organisms and general announcements without the service running too long. I'm allotting us five seconds per name: two for uttering the syllables, and three for silent contemplation and for setting up a good rhythm. That means about 700 names per week. It's a nice number: not so many as to become an undifferentiated torrent, but not so few that the list starts to seem manageable.

76 **hair and fingernails:** Gould, *Book of Life,* p. 39.

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