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.... Here 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
countours 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.