



THE
BOTANY
OF
DESIRE

A Plant's-Eye View of the World

MICHAEL
POLLAN

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INTRODUCTION

The Human Bumblebee

The seeds of this book were first planted in my garden—while I was planting seeds, as a matter of fact. Sowing seed is pleasant, desultory, not terribly challenging work; there's plenty of space left over for thinking about other things while you're doing it. On this particular May afternoon, I happened to be sowing rows in the neighborhood of a flowering apple tree that was fairly vibrating with bees. And what I found myself thinking about was this: What existential difference is there between the human being's role in this (or any) garden and the bumblebee's?

If this sounds like a laughable comparison, consider what it was I was doing in the garden that afternoon: disseminating the genes of one species and not another, in this case a fingerling potato instead of, let's say, a leek. Gardeners like me tend to think such choices are our sovereign prerogative: in the space of this garden, I tell myself, I alone determine which species will thrive and which

will disappear. I'm in charge here, in other words, and behind me stand other humans still more in charge: the long chain of gardeners and botanists, plant breeders, and, these days, genetic engineers who "selected," "developed," or "bred" the particular potato that I decided to plant. Even our grammar makes the terms of this relationship perfectly clear: *I choose the plants, I pull the weeds, I harvest the crops*. We divide the world into subjects and objects, and here in the garden, as in nature generally, we humans are the subjects.

But that afternoon in the garden I found myself wondering: What if that grammar is all wrong? What if it's really nothing more than a self-serving conceit? A bumblebee would probably also regard himself as a subject in the garden and the bloom he's plundering for its drop of nectar as an object. But we know that this is just a failure of his imagination. The truth of the matter is that the flower has cleverly manipulated the bee into hauling its pollen from blossom to blossom.

The ancient relationship between bees and flowers is a classic example of what is known as "coevolution." In a coevolutionary bargain like the one struck by the bee and the apple tree, the two parties act on each other to advance their individual interests but wind up trading favors: food for the bee, transportation for the apple genes. Consciousness needn't enter into it on either side, and the traditional distinction between subject and object is meaningless.

Matters between me and the spud I was planting, I realized, really aren't much different; we, too, are partners in a coevolutionary relationship, as indeed we have been ever since the birth of agriculture more than ten thousand years ago. Like the apple blossom, whose form and scent have been selected by bees over countless generations, the size and taste of the potato have been selected over countless generations by us—by Incas and Irishmen, even by

people like me ordering french fries at McDonald's. Bees and humans alike have their criteria for selection: symmetry and sweetness in the case of the bee; heft and nutritional value in the case of the potato-eating human. The fact that one of us has evolved to become intermittently aware of its desires makes no difference whatsoever to the flower or the potato taking part in this arrangement. All those plants care about is what every being cares about on the most basic genetic level: making more copies of itself. Through trial and error these plant species have found that the best way to do that is to induce animals—bees or people, it hardly matters—to spread their genes. How? By playing on the animals' desires, conscious and otherwise. The flowers and spuds that manage to do this most effectively are the ones that get to be fruitful and multiply.

So the question arose in my mind that day: Did I choose to plant these potatoes, or did the potato make me do it? In fact, both statements are true. I can remember the exact moment that spud seduced me, showing off its knobby charms in the pages of a seed catalog. I think it was the tasty-sounding "buttery yellow flesh" that did it. This was a trivial, semiconscious event; it never occurred to me that our catalog encounter was of any evolutionary consequence whatsoever. Yet evolution consists of an infinitude of trivial, unconscious events, and in the evolution of the potato my reading of a particular seed catalog on a particular January evening counts as one of them.

That May afternoon, the garden suddenly appeared before me in a whole new light, the manifold delights it offered to the eye and nose and tongue no longer quite so innocent or passive. All these plants, which I'd always regarded as the objects of my desire, were also, I realized, subjects, acting on me, getting me to do things for them they couldn't do for themselves.

And that's when I had the idea: What would happen if we

looked at the world beyond the garden this way, regarded our place in nature from the same upside-down perspective?

This book attempts to do just that, by telling the story of four familiar plants—the apple, the tulip, cannabis, and the potato—and the human desires that link their destinies to our own. Its broader subject is the complex reciprocal relationship between the human and natural world, which I approach from a somewhat unconventional angle: I take seriously the plant’s point of view.

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The four plants whose stories this book tells are what we call “domesticated species,” a rather one-sided term—that grammar again—that leaves the erroneous impression that we’re in charge. We automatically think of domestication as something we do to other species, but it makes just as much sense to think of it as something certain plants and animals have done to us, a clever evolutionary strategy for advancing their own interests. The species that have spent the last ten thousand or so years figuring out how best to feed, heal, clothe, intoxicate, and otherwise delight us have made themselves some of nature’s greatest success stories.

The surprising thing is, we don’t ordinarily regard species like the cow and the potato, the tulip and the dog, as nature’s more extraordinary creatures. Domesticated species don’t command our respect the way their wild cousins often do. Evolution may reward interdependence, but our thinking selves continue to prize self-reliance. The wolf is somehow more impressive to us than the dog.

Yet there are fifty million dogs in America today, only ten thousand wolves. So what does the dog know about getting along in this world that its wild ancestor doesn’t? The big thing the dog knows about—the subject it has mastered in the ten thousand years it has been evolving at our side—is us: our needs and desires,

our emotions and values, all of which it has folded into its genes as part of a sophisticated strategy for survival. If you could read the genome of the dog like a book, you would learn a great deal about who we are and what makes us tick. We don't ordinarily give plants as much credit as animals, but the same would be true of the genetic books of the apple, the tulip, cannabis, and the potato. We could read volumes about ourselves in their pages, in the ingenious sets of instructions they've developed for turning people into bees.

After ten thousand years of coevolution, their genes are rich archives of cultural as well as natural information. The DNA of that tulip there, the ivory one with the petals attenuated like sabers, contains detailed instructions on how best to catch the eye not of a bee but of an Ottoman Turk; it has something to tell us about that age's idea of beauty. Likewise, every Russet Burbank potato holds within it a treatise about our industrial food chain—and our taste for long, perfectly golden french fries. That's because we have spent the last few thousand years remaking these species through artificial selection, transforming a tiny, toxic root node into a fat, nourishing potato and a short, unprepossessing wildflower into a tall, ravishing tulip. What is much less obvious, at least to us, is that these plants have, at the same time, been going about the business of remaking us.

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I call this book *The Botany of Desire* because it is as much about the human desires that connect us to these plants as it is about the plants themselves. My premise is that these human desires form a part of natural history in the same way the hummingbird's love of red does, or the ant's taste for the aphid's honeydew. I think of them as the human equivalent of nectar. So while the book ex-

plores the social history of these plants, weaving them into our story, it is at the same time a natural history of the four human desires these plants evolved to stir and gratify.

I'm interested not only in how the potato altered the course of European history or how cannabis helped fire the romantic revolution in the West, but also in the way notions in the minds of men and women transformed the appearance, taste, and mental effects of these plants. Through the process of coevolution human ideas find their way into natural facts: the contours of a tulip's petals, say, or the precise tang of a Jonagold apple.

The four desires I explore here are *sweetness*, broadly defined, in the story of the apple; *beauty* in the tulip's; *intoxication* in the story of cannabis; and *control* in the story of the potato—specifically, in the story of a genetically altered potato I grew in my garden to see where the ancient arts of domestication may now be headed. These four plants have something important to teach us about these four desires—that is, about what makes us tick. For instance, I don't think we can begin to understand beauty's gravitational pull without first understanding the flower, since it was the flower that first ushered the idea of beauty into the world the moment, long ago, when floral attraction emerged as an evolutionary strategy. By the same token, intoxication is a human desire we might never have cultivated had it not been for a handful of plants that manage to manufacture chemicals with the precise molecular key needed to unlock the mechanisms in our brain governing pleasure, memory, and maybe even transcendence.

Domestication is about a whole lot more than fat tubers and docile sheep; the offspring of the ancient marriage of plants and people are far stranger and more marvelous than we realize. There is a natural history of the human imagination, of beauty, religion, and possibly philosophy too. One of my aims in this book is to

shed some light on the part in that history these ordinary plants have played.

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Plants are so unlike people that it's very difficult for us to appreciate fully their complexity and sophistication. Yet plants have been evolving much, much longer than we have, have been inventing new strategies for survival and perfecting their designs for so long that to say that one of us is the more "advanced" really depends on how you define that term, on what "advances" you value. Naturally we value abilities such as consciousness, toolmaking, and language, if only because these have been the destinations of our own evolutionary journey thus far. Plants have traveled all that distance and then some—they've just traveled in a different direction.

Plants are nature's alchemists, expert at transforming water, soil, and sunlight into an array of precious substances, many of them beyond the ability of human beings to conceive, much less manufacture. While we were nailing down consciousness and learning to walk on two feet, they were, by the same process of natural selection, inventing photosynthesis (the astonishing trick of converting sunlight into food) and perfecting organic chemistry. As it turns out, many of the plants' discoveries in chemistry and physics have served us well. From plants come chemical compounds that nourish and heal and poison and delight the senses, others that rouse and put to sleep and intoxicate, and a few with the astounding power to alter consciousness—even to plant dreams in the brains of awake humans.

Why would they go to all this trouble? Why should plants bother to devise the recipes for so many complex molecules and then expend the energy needed to manufacture them? One im-

portant reason is defense. A great many of the chemicals plants produce are designed, by natural selection, to compel other creatures to leave them alone: deadly poisons, foul flavors, toxins to confound the minds of predators. But many other of the substances plants make have exactly the opposite effect, drawing other creatures to them by stirring and gratifying their desires.

The same great existential fact of plant life explains why plants make chemicals to both repel and attract other species: immobility. The one big thing plants can't do is move, or, to be more precise, locomote. Plants can't escape the creatures that prey on them; they also can't change location or extend their range without help.

And so about a hundred million years ago plants stumbled on a way—actually a few thousand different ways—of getting animals to carry them, and their genes, here and there. This was the evolutionary watershed associated with the advent of the angiosperms, an extraordinary new class of plants that made showy flowers and formed large seeds that other species were induced to disseminate. Plants began evolving burrs that attach to animal fur like Velcro, flowers that seduce honeybees in order to powder their thighs with pollen, and acorns that squirrels obligingly taxi from one forest to another, bury, and then, just often enough, forget to eat.

Even evolution evolves. About ten thousand years ago the world witnessed a second flowering of plant diversity that we would come to call, somewhat self-centeredly, “the invention of agriculture.” A group of angiosperms refined their basic put-the-animals-to-work strategy to take advantage of one particular animal that had evolved not only to move freely around the earth, but to think and trade complicated thoughts. These plants hit on a remarkably clever strategy: getting us to move and think for them. Now came edible grasses (such as wheat and corn) that incited humans to cut down vast forests to make more room for them; flowers whose beauty would transfix whole cultures; plants so

compelling and useful and tasty they would inspire human beings to seed, transport, extol, and even write books about them. This is one of those books.

So am I suggesting that the plants made me do it? Only in the sense that the flower “makes” the bee pay it a visit. Evolution doesn’t depend on will or intention to work; it is, almost by definition, an unconscious, unwilling process. All it requires are beings compelled, as all plants and animals are, to make more of themselves by whatever means trial and error present. Sometimes an adaptive trait is so clever it appears purposeful: the ant that “cultivates” its own gardens of edible fungus, for instance, or the pitcher plant that “convinces” a fly it’s a piece of rotting meat. But such traits are clever only in retrospect. Design in nature is but a concatenation of accidents, culled by natural selection until the result is so beautiful or effective as to seem a miracle of purpose.

By the same token, we’re prone to overestimate our own agency in nature. Many of the activities humans like to think they undertake for their own good purposes—inventing agriculture, outlawing certain plants, writing books in praise of others—are mere contingencies as far as nature is concerned. Our desires are simply more grist for evolution’s mill, no different from a change in the weather: a peril for some species, an opportunity for others. Our grammar might teach us to divide the world into active subjects and passive objects, but in a coevolutionary relationship every subject is also an object, every object a subject. That’s why it makes just as much sense to think of agriculture as something the grasses did to people as a way to conquer the trees.

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When Charles Darwin was writing *The Origin of Species*, deciding how best to spring his outlandish idea of natural selection on the world, he settled on a curious rhetorical strategy. Rather than

open the book with an account of his new theory, he began with a side subject he judged people (and perhaps English gardeners in particular) would have an easier time getting their heads around. Darwin devoted the first chapter of *The Origin of Species* to a special case of natural selection called “artificial selection”—his term for the process by which domesticated species come into the world. Darwin was using the word *artificial* not as in *fake* but as in *artifact*: a thing reflecting human will. There’s nothing fake about a hybrid rose or a butter pear, a cocker spaniel or a show pigeon.

These were a few of the domesticated species Darwin wrote about in his opening chapter, demonstrating how in each case the species proposes a wealth of variation from which humans then select the traits that will be passed down to future generations. In the special realm of domestication, Darwin explained, human desire (sometimes consciously, sometimes not) plays the same role that blind nature does everywhere else, determining what constitutes “fitness” and thereby leading, over time, to the emergence of new forms of life. The evolutionary rules are the same (“modification by descent”), but Darwin understood that they’d be easier to follow in the story of the tea rose than the sea turtle, in the setting of the garden than the Galápagos.

In the years since Darwin published *The Origin of Species*, the crisp conceptual line that divided artificial from natural selection has blurred. Whereas once humankind exerted its will in the relatively small arena of artificial selection (the arena I think of, metaphorically, as a garden) and nature held sway everywhere else, today the force of our presence is felt everywhere. It has become much harder, in the past century, to tell where the garden leaves off and pure nature begins. We are shaping the evolutionary weather in ways Darwin could never have foreseen; indeed, even the weather itself is in some sense an artifact now, its temperatures and storms the reflection of our actions. For a great many species

today, “fitness” means the ability to get along in a world in which humankind has become the most powerful evolutionary force. Artificial selection has become a much more important chapter in natural history as it has moved into the space once ruled exclusively by natural selection.

That space, which is the one we often call “the wild,” was never quite as innocent of our influence as we like to think; the Mohawks and Delawares had left their marks on the Ohio wilderness long before John Chapman (aka Johnny Appleseed) showed up and began planting apple trees. Yet even the dream of such a space has become hard to sustain in a time of global warming, ozone holes, and technologies that allow us to modify life at the genetic level—one of the wild’s last redoubts. Partly by default, partly by design, all of nature is now in the process of being domesticated—of coming, or finding itself, under the (somewhat leaky) roof of civilization. Indeed, even the wild now depends on civilization for its survival.

Nature’s success stories from now on are probably going to look a lot more like the apple’s than the panda’s or white leopard’s. If those last two species have a future, it will be because of human desire; strangely enough, their survival now depends on what amounts to a form of artificial selection. This is the world in which we, along with Earth’s other creatures, now must make our uncharted way.

This book takes place in that world; consider it a set of dispatches from Darwin’s ever-expanding garden of artificial selection. Its main characters are four of that world’s success stories. The dogs, cats, and horses of the plant world, these domesticated species are familiar to everyone, so deeply woven into the fabric of our everyday lives that we scarcely think of them as “species” or parts of “nature” at all. But why is that? I suspect it’s at least partly the fault of the word. “Domestic” implies that these species have

come in or been brought under civilization's roof, which is true enough; yet the house-y metaphor encourages us to think that by doing so they have, like us, somehow *left* nature, as if nature were something that only happens outside.

This is simply another failure of imagination: nature is not only to be found "out there"; it is also "in here," in the apple and the potato, in the garden and the kitchen, even in the brain of a man beholding the beauty of a tulip or inhaling the smoke from a burning cannabis flower. My wager is that when we can find nature in these sorts of places as readily as we now find it in the wild, we'll have traveled a considerable distance toward understanding our place in the world in the fullness of its complexity and ambiguity.

I've chosen the apple, the tulip, cannabis, and the potato for several logical-sounding reasons. One is that they represent four important classes of domesticated plants (a fruit, a flower, a drug plant, and a staple food). Also, having grown these four plants at one time or another in my own garden, I'm on fairly intimate terms with them. But the real reason I chose these plants and not another four is simpler than that: they have great stories to tell.

Each of the chapters that follows takes the form of a journey that either starts out, stops by, or ends up in my garden but along the way ventures far afield, both in space and historical time: to seventeenth-century Amsterdam, where, for a brief, perverse moment, the tulip became more precious than gold; to a corporate campus in St. Louis, where genetic engineers are reinventing the potato; and back to Amsterdam, where another, far less lovely flower has made itself, again, more precious than gold. I also travel to potato farms in Idaho; follow my species' passion for intoxicating plants down through history and into contemporary neuroscience; and paddle a canoe down a river in central Ohio in search

of the real Johnny Appleseed. Hoping to render our relationships with these four species in all their complexity, I look at them, by turns, through a variety of lenses: social and natural history, science, journalism, biography, mythology, philosophy, and memoir.

These are stories, then, about Man and Nature. We've been telling ourselves such stories forever, as a way of making sense of what we call our "relationship to nature"—to borrow that curious, revealing phrase. (What other species can even be said to have a "relationship" to nature?) For a long time now, the Man in these stories has gazed at Nature across a gulf of awe or mystery or shame. Even when the tenor of these narratives changes, as it has over time, the gulf remains. There's the old heroic story, where Man is at war with Nature; the romantic version, where Man merges spiritually with Nature (usually with some help from the pathetic fallacy); and, more recently, the environmental morality tale, in which Nature pays Man back for his transgressions, usually in the coin of disaster—three different narratives (at least), yet all of them share a premise we know to be false but can't seem to shake: that we somehow stand outside, or apart from, nature.

This book tells a different kind of story about Man and Nature, one that aims to put us back in the great reciprocal web that is life on Earth. My hope is that by the time you close its covers, things outside (and inside) will look a little different, so that when you see an apple tree across a road or a tulip across a table, it won't appear quite so alien, so Other. Seeing these plants instead as willing partners in an intimate and reciprocal relationship with us means looking at ourselves a little differently, too: as the objects of other species' designs and desires, as one of the newer bees in Darwin's garden—ingenious, sometimes reckless, and remarkably unself-conscious. Think of this book as that bee's mirror.