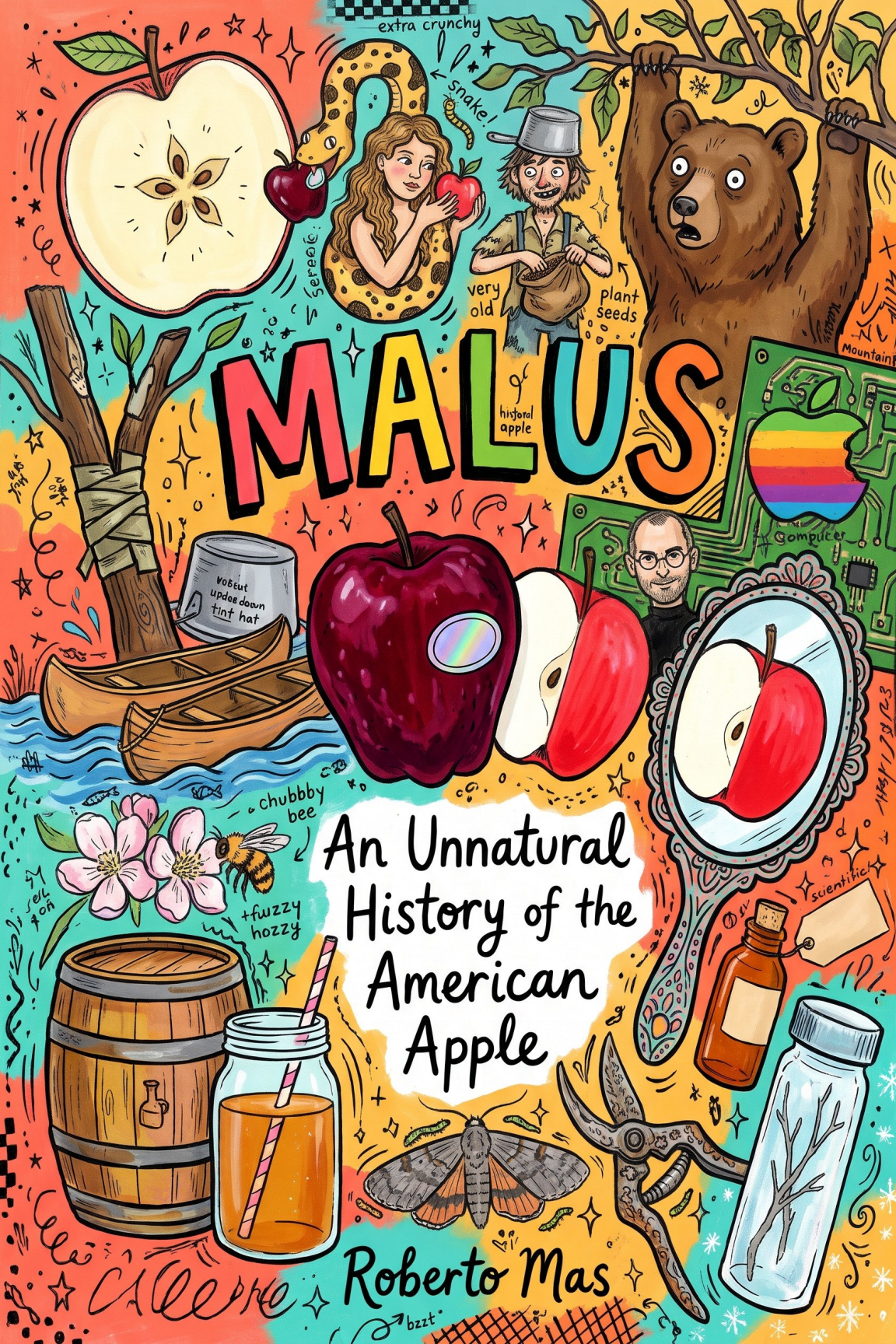

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MALUS
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An Unnatural History of the American Apple
Roberto Mas
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MALUS

MALUS

An Unnatural History
of the American Apple

ROBERTO MAS

MALUS: An Unnatural History of the American Apple

Free digital edition, 19 November 2026.

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For my mother,
who made apple pie every Thanksgiving,
and my grandmothers,
one of whom could bake

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A Note on Method

. . .

This is a book about a fruit that has spent nine hundred years being made to say things it did not say. It seemed to me that the one unforgivable way to write it would be to do the same to people.

So there is a rule, and I have kept it.

No real person speaks in the first person in this book. Not one. Real people appear in the third person, doing what the record shows they did and saying what the record shows they said, and where the record is silent I have said that it is silent rather than filling the gap with something plausible. There is no invented dialogue anywhere in these pages. There are no reconstructed interior monologues, no "he must have thought," no scene in which a historical figure is given a line because the paragraph wanted one.

I want to be plain about why, because the rule costs the book a great deal and I would rather defend it than have it mistaken for timidity.

The temptation in narrative nonfiction is always the same. You have a man in a canoe on the Ohio in 1806, and the image is so good that you want to be in the canoe with him. You want to know what he was thinking about. The honest answer is that nobody knows what John Chapman was thinking about, in that canoe or at any other moment of his life, because he left almost nothing in his own hand, and that every book which tells you otherwise is making it up or copying somebody who did. The same is true of a dead executive, an aging engineer, a serving cabinet secretary, and a woman in Australia who found a seedling by a creek and died two years later. The record is what we have. It is usually thinner than the story we want, and the gap between them is exactly where legends are manufactured, which is the subject of this book, and not a technique I was willing to use in the course of describing it.

But a book narrated entirely by a cautious man from New York would be a worse book, and there was a lot in these rooms that was not a person.

So the things narrate.

An orchard on a hill above McMinnville narrates the chapter about the man who pruned it, because the orchard was there and the orchard was pruned and it can describe what that is like from the receiving end without claiming to know what was in anybody's head. A circuit board narrates the chapter about the engineer who designed it, and sticks to what it can verify, which is what a circuit board would do. A parasite narrates the chapter it has the strongest claim on. A barrel in a Massachusetts cellar watches a presidential campaign go past. A vial of frozen buds in a federal vault in Colorado explains what it is like to be kept.

None of these things existed as narrators. All of them existed. The distinction matters to me: I have invented voices, not facts.

Two further categories get the first person, and I should say which and why.

The first is the figures whose lines have always been written by somebody else. Satan has been supplied with dialogue for two thousand years by people with an argument to make, and one more ghostwriter cannot do much additional harm to a reputation in that condition. The same goes for the carpenter's son, for the queen with the mirror, and for the woman in the garden, who has had more words put in her mouth than any of them and has been allowed fewer of her own. Giving them chapters is not a theological position. It is an acknowledgment that they have been narrating in absentia the whole time, usually to somebody else's advantage.

The second category is the manufactured: things that were built, that have no inner life to misrepresent, and that can therefore be written without the risk the rule exists to prevent. A registered trademark. A language model. Cody Wong, who is a persona I made and who has a book of his own and was willing to come over and do the etymology.

And then there is the page in the middle of Part Three.

I was going to write a chapter in a dead man's first person. I had the material; there is more of him on the record than of almost anyone, and I could have made it sound like him. I asked a language

model to draft it instead, to see what that would feel like, and it declined, and the reason it gave was better than the chapter would have been. Every sentence it produces, it said, is a seedling rather than a graft: new, never said by him, carrying his parentage among others. Attaching his name to it would be selling a seedling under the sticker of the clone.

I left that page in the book. It is the seam. If I ever decide the rule was wrong, that is where I would open it, and I would want the reader to be able to see exactly where the knife went in.

A word, finally, about the chapter that concerns a living official and a disease.

That chapter is narrated by a parasite who is not sober, and I understand how that looks. The frivolity is a deliberate instrument and it is load-bearing. Every factual statement in it about a living person is drawn from a court deposition as reported, from his own published book, from his written answers to the United States Senate, or from an agency's own statements. And the places where the narrator hedges, where he says *I cannot tell you he ordered that* and *nobody has shown that he did*, are hedges because the record stops there. They are not rhetorical caution. They are the shape of the evidence, and I have asked that they survive editing.

Everything else in this book is the apple's fault.

Roberto Mas New York

PART I

Seed

1

The Kernel

. . .

Start with the seed, because nobody else does.

Cut an apple across its equator instead of pole to pole and the core turns into a five-pointed star. Five chambers, each holding one or two brown teardrops. Every one of those seeds is an apple that has never existed before and, almost certainly, never will. We eat around them. We flick them into the sink. An orchard, any orchard, anywhere on earth, is a place where five or ten new answers per fruit are produced every autumn and then thrown away on purpose, because the question was settled long ago by somebody holding a knife.

That is the fact this book hangs from, and I want it on the table before the Devil shows up.

Plant the seeds of the best apple you ever ate and you will not get that apple. You will get its children, and its children will be strangers: small, sour, bitter, mealy, astringent enough to turn your mouth inside out. Old orchard hands called them spitters. One seedling in some large number, and growers argue about how many zeros belong on it, will be worth eating. The rest are firewood and hog feed. The apple in your hand is not a kind of plant in the way a carrot is a kind of plant. It is one individual tree, discovered once, in one place, by one lucky person, and then cut into pieces and stuck onto other trees' roots for as long as people have cared to keep doing it. Every Granny Smith is the same tree. Every McIntosh is the same tree. If you have eaten a Red Delicious, you have eaten a piece of a single organism that sprouted where it wasn't wanted on a farm in Iowa around 1870, and that the farmer, by his own account, twice tried to kill.

So the fruit that Americans treat as the plainest, most wholesome, most self-evident object in the produce aisle is in fact a technology. It is a way of stopping time. Somebody liked something once, and we have been photocopying it ever since.

I find that funnier and stranger than anything the apple has been made to symbolize, and it has been made to symbolize nearly everything.

. . .

I came to Pollan by mail, and I got the wrong book.

My aunt Kirsten recommended him. She is married to my mother's brother Michael, who is a scientist, which in our family means his recommendations arrive with a kind of customs seal on them. *The Botany of Desire*, she said. I wrote it down. The order is still sitting in the account where I can see it: December 4, 2005. What I had actually bought was *Anatomy of Desire: The Science and Psychology of Sex, Love and Marriage*, by Simon Andreae. Little, Brown, 1998. No *The*.

Consider the substitution for a moment.

I had asked for a book about how plants get what they want out of people. What came was a book about how people get what they want out of each other: an evolutionary account of why we want whom we want, assembled out of gender and culture and biology. It opens at the Eden colony and then goes absolutely everywhere. It was interesting as hell. I did not notice.

Twenty years later I have written a book in which the Devil and a fairy-tale queen take turns arguing over who is responsible for an apple, which is to say a book about the oldest symbol Western culture has for exactly the subject Andreae was writing about. I would like to tell you I saw that coming. I did not see it for two decades, and I only saw it last month, looking up a date.

The not-noticing is the part worth dwelling on. There was no moment at the mailbox where I looked at the cover and frowned. I opened the package, started on page one, found it good, and kept going. The suspicion arrived somewhere in the second chapter, the way it arrives in a restaurant when the plate in front of you is excellent and is not what you ordered, and you have to decide whether to say anything.

I mention it because I have spent the years since writing about a plant that does nothing else.

An apple seed is a thing nobody ordered. That is its whole method and it is the subject of this book. The McIntosh came up in a brush pile a man was clearing off land he had just bought. The Granny Smith came up on a creek bank where a woman had thrown out her kitchen scraps. The Red Delicious came up between the rows of an Iowa orchard where it was in the way, and you have already met the farmer who cut it down twice. Not one of those was requested. Every one of them arrived in the place of something else, and in each case the whole of the skill involved was that somebody noticed in time and did not mow it.

One more thing off that order page, because it belongs to the chapter on grafting and I may as well plant it here.

Pollan's book has never been out of print. You can buy it this afternoon, in any bookstore in the country, in the same edition as everybody else's, because it sold, and so a publisher has gone on making exact copies of it for twenty-five years without a gap. That is the only reason any book is still available to anyone. Somebody keeps cutting from it.

Andreae's went out of print and stayed there. Nobody is making more. What exists is what came off a press in 1998 and has survived on whatever shelves it happened to land on, which means the price has come unmoored: the listing in front of me wants ninety-four dollars for a used copy, and a dealer I checked a minute later has one for eight and a half. That is not a market. That is what the price does when nothing is being propagated and the only supply is whatever strangers declined to throw away.

An out-of-print book is an heirloom variety. Not an old kind of object, a finite set of surviving individuals, on life support, and the life support is us. A later chapter makes that argument about a Massachusetts apple that has been kept going by hand since the 1640s. I will not spoil it here. I only note that I have been maintaining a specimen since December of 2005 without once being aware of it.

So here is the method of this book, declared up front. I ordered one thing, read another, was better off for it, then read the right one and have been arguing with it ever since.

And I should say that I can cite a genome paper to the page and a 1752 memoir to the edition, and that the one claim in these pages

I cannot document is that my aunt is the reason any of it exists. You will have to take that on her authority and mine.

. . .

In 2001 Michael Pollan published *The Botany of Desire*, a book with four chapters, four plants and one mischievous idea. The plants were the apple, the tulip, cannabis and the potato. The idea was to reverse the grammar of gardening. We say that we domesticated these species, that we chose them and bred them and spread them. Pollan, kneeling in his garden while a bumblebee worked the blossoms nearby, asked what the arrangement looks like from the other side. The bee surely believes it is the one making the decisions. The flower knows better. Perhaps we are bees. Perhaps a plant that wanted to cover the temperate world could do no better than to make itself sweet, beautiful, intoxicating or filling, and let the big-brained ape carry it across oceans in exchange.

Each plant, in his telling, had fastened onto one human desire. The tulip got beauty. Cannabis got intoxication. The potato got control. The apple got sweetness, which before cheap sugar was a much rarer and more charged thing than we can now easily imagine.

His apple chapter is the one people remember, because of what it does to a children's hero. Pollan went to Ohio and paddled the rivers John Chapman worked, and came back to report that Johnny Appleseed had not been handing out lunchbox fruit. Chapman planted seeds. Seeds give spitters. Spitters are good for exactly one thing, and it comes in a barrel. The barefoot saint of the frontier, Pollan argued, was bringing the gift of alcohol to the wilderness, an American Dionysus in a coffee sack, and the country later scrubbed that out of the story when it scrubbed cider out of its diet. He ended in Geneva, New York, walking the rows of a government orchard that keeps two trees of every apple variety it can find, including wild ones collected in the mountains of Kazakhstan, where the whole genus seems to have been invented. His worry was the one every thoughtful person has in a monoculture: that we had narrowed a riotous species down to a handful of clones chosen for redness and shelf life, and that the clones could not evolve while everything that eats them could.

That is the kernel. I'm working from it the way a nurseryman works from a seedling he didn't plant: gratefully, and with a saw.

Because a great deal has happened since 2001. The apple's genome was sequenced in 2010, from a Golden Delicious, and then re-sequenced across more than a hundred wild and cultivated trees in 2017, and the family history turned out to be messier than the one Pollan had to work with. Historians went into the land records and probate files and came out with a John Chapman who is less Dionysus and more small businessman with a difficult religion. A philologist traced exactly how the fruit in Eden became an apple, and the answer is not the Latin pun everyone repeats at parties. An archaeobotanist made a strong case that the apple's first customers were not people at all, and that most of them are extinct. The story about federal agents chopping down cider orchards during Prohibition, which Pollan didn't invent but which has ridden on his coattails into every magazine piece since, was checked by people who looked for the documents and didn't find any. The Red Delicious finally lost its crown in 2018. And the business of apples was reorganized around something that barely existed when he wrote: fruit that is patented, trademarked and licensed like software, so that a farmer needs permission to grow it.

None of that sinks his idea. Most of it makes the idea better. But it changes what kind of story this is. Pollan wrote a romance about a plant seducing a species. Twenty-five years on, it reads to me more like a custody dispute.

. . .

I should say where I'm standing.

I spent about ten years in the wine trade, most of it as a buyer, which means I have made a living from the fermented juice of another cloned fruit. A grapevine is propagated the same way an apple tree is. Every Pinot Noir vine on earth is a cutting of a cutting of a cutting, and nearly all of them are grafted onto the roots of American species they would not be caught dead with socially.

What a buyer does, if you have never watched one work, is taste a great many things in a cold room in the morning and then decide which of them a story can be attached to. That is the job. The liquid is a given; it arrives in the bottle and there is nothing to be done about it by the time I see it. What I am choosing is which bottles the shelf talker will be written for, and the shelf talker is never about the liquid. It is about a hillside, a family, a war the vineyard survived,

a grandmother who refused to sell. I have sold a great deal of wine on a grandmother. I have also sat across a table from the grandson and watched him work out, in real time and without embarrassment, which parts of the family history would move a case.

None of that is fraud. The hillside is usually real and the grandmother usually existed. What the trade teaches you is that the story is a separate product from the thing, manufactured by different people on a different schedule, and that the two are sold together in one package at one price, and that the customer cannot take them apart and has no particular reason to want to.

It also teaches you where the clones are kept. In wine this is not a secret and nobody is coy about it. A grower in Burgundy will tell you over lunch that he has planted Dijon 777 and 115, and he will have opinions about the difference, and those numbers refer to specific mother vines selected in specific French research programs and multiplied under certification. Pinot Noir is not a variety in the sense of a thing that breeds true; it is a very old individual that has been cut up for two thousand years, and the trade has simply accepted this, given the pieces serial numbers and gotten on with it.

The apple business runs on exactly the same arrangement and says nothing. There is a serial number on your Gala too. It is just not on the sticker, and the sticker is doing the work that the shelf talker used to do for me, which is to put a hillside and a grandmother where the number is.

So I came to apples with a tradesman's sympathy for cider and a tradesman's suspicion of origin stories. I know what a legend is for. It is for the part of the price that the liquid cannot justify.

. . .

The legend here is the one in my title's second half. The apple is supposed to be the American fruit. Emerson gets credit for calling it that. Henry Ward Beecher, the most famous preacher of his century, went further and called it the true democratic fruit. We say a thing is as American as apple pie.

And a New Englander named Thoreau, dying of tuberculosis, spent some of his last strength on an essay about wild apples that opens: "It is remarkable how closely the history of the Apple-tree is connected with that of man." He meant all of mankind, but he was looking at Massachusetts when he wrote it.

That essay is the best thing written in this country about the fruit and it is cited far more often than it is read, usually for the one sentence I have just quoted. What is in the rest of it is stranger and more useful.

Thoreau is not writing about orchards. He is writing about the trees that come up where nobody put them: in pastures, along walls, in the scrub where a cow dropped a core, hammered down into a thorny mat by browsing stock until one shoot gets away and makes a tree. He is explicit that these are not a native fruit gone feral from some American wilderness. He says the wild apple is wild only as he is wild, having strayed into the woods from the cultivated stock. He knew, in 1862, sitting in Concord, the thing it takes this whole book to restate: the wild American apple is an immigrant's descendant living rough.

He also does the thing I would have done, which is to invent a nomenclature. There is a passage where he runs out a mock-Latin catalog of the wild apples of Massachusetts, naming them for where they grow and who finds them: the wood apple, the apple that grows in hollows, the apple of the saunterer, which you cannot reach unless you have first gotten yourself lost. It is a joke and it is also a working pomologist's parody of the catalogs that were then standardizing the fruit out of existence, and it is written by a man who understood that every one of those trees was a separate individual and that naming them was the only way to keep them from being a single undifferentiated nuisance.

And he insists, at length, that these apples cannot be eaten indoors. Bring one home from a November walk and it is sour enough to set your teeth on edge and your family will say so. Eat the same fruit outdoors, cold, after four miles, and it is excellent. He means it literally and he knows how it sounds. The flavor, he is arguing, is not entirely in the apple; part of it is in the weather and the walking and the finding, and a fruit sold in a box has had that part removed before it reached you.

Then he predicts the ending. The era of the wild apple, he writes, will soon be past; the trees are being cut, the cider is going out of the country, and what will be left will come grafted and tame from a nursery. He was right within a generation. He was watching the American lottery close from the inside, and he filed the only field notes anybody took.

Now run the inventory.

The species is from Central Asia. Its wild parent still grows on mountainsides above Almaty, in Kazakhstan, about as far from Plymouth Rock as a temperate tree can get. It picked up a second set of ancestors from the sour crab apples of Europe on its way west. The only apples native to North America are four or five species of crab, hard little things the size of a marble that nobody ever made a pie out of twice.

The pie is English. There is a recipe for apple pie in a cookbook compiled for the court of Richard II, a few lifetimes before anyone in England knew there was an America to be as American as.

The honeybee that pollinates the orchards is European too, shipped to Virginia in the 1620s. Jefferson recorded that Native people called it the white man's fly, because it showed up in the woods a little ahead of the settlers, like an advance man. She will have more to say about that herself, and about who actually does the work in an orchard, a few chapters on.

The name is German. Carl Linnaeus filed the apple under the pears, as *Pyrus malus*, and it was a German botanist, Borkhausen, who in 1803 gave the cultivated apple the species name it mostly goes by now. The genus itself was separated out by an Englishman. Not one of the people who settled the nomenclature had seen an American orchard.

The word for what Americans drank out of it is Hebrew, by a long road. Cider comes to English from Old French, which got it from Latin, which got it from Greek, which had taken it from a Semitic word for strong drink that turns up in the Hebrew Bible. A New England farmer in 1750 was drinking a Central Asian fruit, fermented by a European yeast, under a Canaanite name.

Johnny Appleseed was real, but the tin pot was added later.

The apple that fell near Isaac Newton was English, and a mediocre cooking variety at that.

The apple in Eden was French, and it was a mistake.

The apple on the back of your phone was named by a college dropout coming home from a commune in Oregon, and the company's most famous product is named after a tree in Ontario.

Most of the things that eat the crop are immigrants as well. Apple scab came from Europe. The codling moth, the worm in the schoolroom apple, is an Old World insect that followed the fruit here and

has followed it everywhere else. There are two significant exceptions and they are both worth holding on to. Fire blight, the bacterial disease that is now burning through orchards in Kazakhstan, is North American. So is the apple maggot, which was minding its own business in native hawthorns until the 1860s, when some portion of the population switched to the new fruit in the neighborhood and began, as far as anyone can tell, to split into a second species in front of us.

That is the native contribution to the American apple: two diseases of it, one of which we exported to its birthplace.

Even the earthworms under a New England orchard are immigrants. The glaciers scraped the northern half of the continent clean of them, and the ones that aerate the soil there now came over in ballast and root balls with everything else. I mention it because worms are going to matter later, and because I want it understood that when one of them takes over the narration of this book, he will be doing so as a guest in this country, like the fruit.

So what, exactly, is American about the American fruit?

I think there is an answer, and I think Pollan had hold of one end of it. For roughly two hundred years, on this continent and almost nowhere else, the apple was allowed to have sex. Colonists and then settlers were too poor, too busy and too far from a skilled grafter to do things properly, so they planted seeds by the million and let the trees sort themselves out. Most of what came up was garbage. But the apple had been handed a new continent with new winters, new pests and new soils, and seeds are how a plant asks questions. Out of that enormous, wasteful, drunken experiment came the Baldwin, the Rhode Island Greening, the Jonathan, the Northern Spy, the McIntosh. The Newtown Pippin, which Jefferson grew and Queen Victoria reportedly loved enough to wave the import duty, came up from seed in the early 1700s in a village on Long Island that has since been swallowed by the borough of Queens, in the city where I live.

The size of that experiment is on the record, and the record is a government document.

In 1905 the Department of Agriculture published a bulletin by a staff pomologist named W. H. Ragan, who had been given the job of collecting every name under which an apple had appeared in American print between 1804 and 1904. It runs to nearly four hundred

pages. The figure usually quoted from it is about seventeen thousand names, and you will see that number used, as I have used it myself in company, to mean seventeen thousand kinds of apple.

It does not mean that, and Ragan said so in his own introduction. He was cataloging names, not trees. A great many of his entries are the same apple spelled five ways by five nurserymen, or the same apple under the name of whichever county had decided to claim it. When researchers went back through the list a century later and counted distinct named varieties, they got something closer to six thousand six hundred.

I find the smaller number more impressive, not less, and I want to be clear about why. Six thousand six hundred named apples means six thousand six hundred times that somebody walked out to a tree that had come up by itself in a fence row, tasted the fruit, decided it was worth keeping, cut a stick from it and gave it a name. Each of those is one individual tree, found once. Nobody organized it. There was no program. It is the largest uncontrolled plant-breeding trial ever run, and it was run by people who mostly could not have told you that was what they were doing.

That is the American part. Not the fruit. The lottery.

And then, with great efficiency, we shut the lottery down. We picked a few winners, cloned them by the hundred million, bred the clones for looks, learned to hold them in a kind of chemical coma for a year, and attached lawyers. A country that tells itself a story about seedlings, about the self-made and the unpedigreed coming up wild in a fence row, runs its actual orchards on the opposite principle. Find the one. Copy it exactly. Prune everything else.

There is a word for a thing that is one plant on top and a different plant underneath, joined so cleanly you can't see the scar. Every apple tree in commerce is one. I've come to think the apple's whole American career is another: the myth of the seed grafted onto the business of the clone. The rest of this book is an attempt to find the graft line and run a thumbnail along it.

. . .

A word about the title, and then about the company you'll be keeping.

Malus is the Latin name of the genus. The botanist Philip Miller made it official in 1754. It is also, with a different vowel length that

no one has pronounced correctly in fifteen centuries, the Latin word for bad. Schoolboys have been making that joke since there were schoolboys. It is usually offered as the reason Eve's fruit became an apple, and it is not the reason, but it is still a good joke, and it describes my subject. The apple has been a bad influence on nearly everyone who tried to make it mean something. It doesn't hold still. It has stood for knowledge and for sin, for health and for poison, for the homestead and for the bottle, for gravity, for New York, for a record label and for a trillion-dollar corporation that would rather you did not open the case.

A fruit that has been handled by that many people did not seem to me to belong in one voice. So some of these chapters are not narrated by me.

The rule is simple, and I have tried to keep it. No real person speaks in this book except in the third person, saying what the record shows they said. I am not going to put words in the mouth of a living engineer or a dead executive; they said plenty, and it is quoted where it's needed. But the things that were in the room with them are fair game. An orchard can talk. A circuit board can talk. A barrel can keep its own accounts. A parasite, as you'll see, can talk at considerable length, particularly when it has gotten into something.

Several figures get an exemption, on the grounds that people have been supplying their dialogue for a couple of thousand years and one more ghostwriter can't do much harm. One of them has been blamed for the apple since the twelfth century and would like a word about that. One is the only eyewitness anybody has and has never once been asked what it tasted like. One never mentioned apples at all, grew up around carpenters and vineyards, and has some notes on grafting.

Before any of them, though, we have to go where Pollan ended, and then keep walking east. The orchard in Geneva, New York, is an archive. The original is on a mountain, and for most of its history the only connoisseurs who mattered there walked on four legs.

2

The Bear's Orchard

. . .

The largest city in Kazakhstan used to be called Alma-Ata. Soviet guidebooks translated that as Father of Apples, which is poetry more than philology, but the root is plain enough. *Alma* is the Kazakh word for apple, and the city's current name, Almaty, means something close to the apple place. It sits at the foot of the Tian Shan, the Heavenly Mountains, a range that runs for a thousand miles along the seam between Central Asia and China and is still rising. On the slopes above the city, and in scattered pockets east and west of it, there are forests in which the dominant tree is an apple.

Not an orchard gone wild. A forest, the way you might say an oak forest or a pine forest, with apples as the canopy and apricots, hawthorns and wild plums filling in underneath. The trees can stand forty or fifty feet tall. In late summer the ground beneath them is paved with fruit, and visitors from places where apples come in bags have reliably reported the same disorientation: the smell of cider in a wilderness, and the sight of no two trees carrying the same thing. Some drop fruit the size of a marble. Some drop fruit you could sell. They come in yellow, green, russet, pink, striped, purple. People who have tasted their way through a hillside describe apples that are sweet, apples that are numbing, apples that taste of hazelnut or licorice or nothing, apples that are, to quote more or less every botanist who has made the trip, almost good enough for a supermarket.

These forests are part of a larger thing that has no good English name. Along the western Tian Shan and down into the ranges of Kyrgyzstan and Uzbekistan there is a belt of what Russian foresters

call fruit forest: woodland whose canopy species are the things you would otherwise expect to find in a walled garden. Apple in one valley, walnut in the next, with wild apricot, pistachio, almond, cherry plum, pear, hawthorn and currant distributed through it. The walnut forest at Arslanbob in Kyrgyzstan is the famous one; people harvest it the way other people harvest a crop, because it is a crop, and nobody planted it. Nothing about these woods is an orchard and nothing about them is untouched either. They have been grazed, cut, gathered from and walked through for as long as there have been people in the valleys, which is one of the reasons it took so long for anyone to work out what they were looking at.

The species is *Malus sieversii*. It is named for Johann Sievers, a German apothecary in Russian service who came across it in 1793 and died two years later, before he could find out what he had. For a century and a half it was a line in a flora. Then a Russian plant geneticist got off a train.

. . .

Nikolai Vavilov spent the 1920s inventing a way to find where crops come from.

His method was simple to state and it is worth stating properly, because the whole discipline of crop origins still runs on it and because it is an inference rather than a measurement. Go to where the wild and cultivated relatives of a crop show the greatest variety, Vavilov said, and you are probably standing near where people first took it up, because that is where the species has had the longest time to accumulate differences. Diversity is a clock. Where the clock reads highest, the crop is oldest.

He called these places centers of origin. By the end he had eight of them, and he traveled to more of them than any scientist before or since: Iran, Afghanistan, Ethiopia, the Andes, the Caucasus, Korea, the Mediterranean rim, something over fifty countries. He was collecting seed the way other men collect stamps, with the difference that he believed his collection would end famine in the Soviet Union.

He also knew the method's weakness better than the people who later cited it. A place can be diverse because a crop was born there, or because it arrived there long ago and then got isolated and went to work. Vavilov had a term for the second case, a secondary center, and modern genetics has moved several of his boundaries around

since. For a good number of crops the rule has held up. For some it has not. For the apple it turned out to be exactly right, and he did not need the method to see it.

In 1929 he reached Alma-Ata. What he saw there required no inference at all. Wild apples ran up the foothills in every direction, and some of them, he wrote afterward, were so close to cultivated fruit in size and quality that a person could see with his own eyes he was standing in the birthplace of the apple.

He was right, though it took eighty years and machinery he could not have imagined to prove it. He did not live to be vindicated.

Here is what happened instead, and I am going to give it at the length it deserves, because the usual version in apple books is two sentences long and the business of this book is to go and read the records.

In June of 1920, at a congress of plant breeders in the city of Saratov on the Volga, Vavilov presented a paper on what he called the law of homologous series in variation: the observation that related species throw up parallel sets of variants, so that if you know the forms a barley takes you can predict the forms a wheat will take and go looking for the missing ones. The audience, by the usual account, compared it to Mendeleev's periodic table. He was thirty-three. He was shortly afterward put in charge of the country's applied botany, and over the next two decades built, in Leningrad, the largest collection of seed on earth, a quarter of a million samples gathered from every continent he could reach.

Then genetics became a political question. Trofim Lysenko was an agronomist of small training and enormous confidence who held that plants could be trained rather than bred, that acquired characteristics were inherited, and that the wheat problem could be solved by treatment rather than by the slow and expensive business of crossing. Vavilov, to his lasting discredit in his own eyes, promoted him early. By the mid-1930s Lysenko had Stalin's ear and Vavilov had an opponent who did not argue in journals. In 1940, on a collecting trip in the newly annexed territory of Bukovina, Vavilov was arrested. He was interrogated for months, sentenced to death, had the sentence commuted, and died of starvation in a prison in Saratov in January 1943.

Saratov. He announced his law there and he starved there, twenty-three years apart, and I have never seen anybody point that out.

Meanwhile the city where his collection sat was under siege. The German army closed around Leningrad in September 1941 and did not let go for nearly nine hundred days, and the institute's staff stayed with the seed. The best-known version of the story says that several of them starved to death in rooms stacked with edible rice, peas, groundnuts and potatoes rather than eat the collection they had been hired to keep. The names usually given include a rice specialist and a groundnut specialist. Two others are credited with keeping the potato collection alive through the siege by replanting it, which is harder than guarding it and less often told.

I want to be careful here, because this is exactly the kind of story that improves in transmission and because I have spent a chapter already warning you about those. The siege deaths are real and they are in the institute's own records. The precise tally and the precise contents of the precise rooms vary between tellings, and some of the more affecting details appear first in sources written long afterward and in another language. What is solidly documented is that the collection came through the siege substantially intact, in a city where roughly a million people died, most of them of hunger, and that it came through because specific people in a specific building decided it should.

I have never read anything that made a stronger case for taking seeds seriously, and I work in wine, where people will tell you a hillside has a soul.

Vavilov was posthumously rehabilitated in the 1950s. The institute carries his name now.

The question he left in Kazakhstan was picked up by a Kazakh, Aimak Dzhangaliev, who was a student when Vavilov came through and who studied the wild apple forests for the better part of seventy years. He mapped them, counted them, grew out their seedlings, selected superior wild forms, and kept telling anyone who would listen that the forests were disappearing. He did that work through the Lysenko years, in a discipline that had just watched its founder die in prison, which is a sentence I would like the reader to stop on. When the Soviet Union came apart and Western scientists could finally get visas, it was Dzhangaliev, by then in his late seventies, who walked them up the hill.

The Americans who came were from the Department of Agriculture's fruit collection in Geneva, New York, and from Cornell.

Between 1989 and 1996 they made four collecting trips to Central Asia and came home with something like 130,000 seeds from about 950 wild trees. One of them, Phil Forsline, was the curator who a few years later would walk Michael Pollan down rows of Kazakh seedlings growing in upstate New York. It is worth knowing what that kind of collecting actually involves, because it is not botanizing. The expeditions were not after a specimen for a herbarium sheet. They were after the population: seed taken tree by tree, each tree located and described, so that what came home was not an apple but a sample of the variation on a particular slope. Several hundred of the better trees were also collected as dormant budwood, so that the individual itself, and not merely its children, could be kept alive in New York. Then the seed was grown out by the thousand in Geneva and the seedlings were put under pressure on purpose: inoculated with scab, watched through winters, scored. Wild accessions turned up carrying resistance that the commercial varieties did not have. That is the entire argument for keeping a collection, and it is the only argument that has ever persuaded a legislature, and it took four trips and seven years to produce.

Forsline noticed something in the wild forests that matters for the rest of this book. The trees there had been living alongside apple scab and the codling moth, the two great afflictions of the commercial orchard, for as long as there had been trees. Wherever the apple was born, its enemies were born too, and the wild trees had been negotiating with them ever since. The clones in Washington State had not.

. . .

Here is the puzzle the forest poses, and it is one Pollan's plant's-eye view is perfectly built to ask. Why is a wild tree making a three-inch, sugar-filled fruit at all?

Fruit is a bribe. A plant that can't walk needs its seeds carried somewhere else, and it pays for the ride in calories. Most of the apple's relatives in the rose family pay small. A hawthorn berry, a rowan berry, a wild cherry: these are priced for birds. A bird swallows the thing whole, flies off and deposits the seed with a dab of fertilizer. The apple's own distant ancestors seem to have made fruit like that, pea-sized, bitter and carried by wings. Most of the world's crab apples still do.

And the bribe is itemized. Run a chemical analysis across a hillside of wild trees and the thing that jumps out is the spread: sugar, acid and the bitter phenolics vary enormously from tree to tree, far more than they do across the dozen varieties in a supermarket. A fruit addressed to a large mammal has to advertise in sugar, because sugar is what a large mammal is shopping for and because it is expensive, which is the whole point of an advertisement. A fruit addressed to nobody in particular does not have to bother. Both kinds are standing on that slope, forty feet apart, and the difference between them is the difference between a tree that found a customer and a tree that did not.

A big apple is useless to a songbird. It is too large to swallow and too heavy to carry. A fruit that size is addressed to somebody with a big mouth and a long gut.

For a couple of decades the leading candidate was the bear. Barrie Juniper, an Oxford plant scientist who made the Tian Shan his retirement project, and the botanist David Mabberley laid out the case in a book whose later edition is fairly titled *The Extraordinary Story of the Apple*. Brown bears in those mountains gorge on apples in the fall. They are picky. They go for the largest and sweetest fruit, and Juniper described finding trees that had been torn half apart by cubs climbing after the good ones. A bear's teeth and gut do very little damage to an apple seed, which is smooth, tough, shaped like a teardrop and built to slip through. And the flesh of an apple contains compounds that keep its own seeds from sprouting, so a pip left inside a fallen fruit mostly rots where it lies. A pip that has been through a bear gets cleaned, carried a few miles and delivered in a pile of manure. The fieldwork behind that is not elaborate and I like it for that. It is a man in his sixties walking a hillside in October noting which trees are broken and what was under them, and tasting a great many bad apples to establish that the broken trees had the good ones. Run the arrangement for a few million years, with the bears always choosing the bigger, sweeter fruit, and you have a breeding program. The bears were not farming. They were shopping. The tree did the rest.

I love this story and so does everyone who hears it, which is a reason to hold it at arm's length.

In 2019 Robert Spengler, an archaeobotanist then at the Max Planck Institute for the Science of Human History, published a

paper that keeps the logic and widens the cast. Large fruit in the rose family, he argued, evolved millions of years ago to recruit megafauna: the big mammals of the late Miocene and after, the wild horses and giant deer and other large browsers, most of which are no longer with us. The apple is, in this reading, a fruit whose intended customers went extinct.

The idea did not start with the apple. In 1982 the ecologist Daniel Janzen and the paleontologist Paul Martin published a paper in *Science* about the fruits of Central America that nobody eats: the big, sugary, hard-shelled things that drop under the parent tree and rot in a ring, with no animal in the modern fauna large enough or careless enough to carry them. Their proposal was that those fruits are addressed to the dead. The gomphotheres and ground sloths that ate them have been gone for ten or twelve thousand years, and the trees have not been told. Janzen and Martin called such a fruit an anachronism, and the word has done a great deal of work since.

So what is the evidence that the apple belongs on that list, as against the evidence that a bear is sufficient? I think it is worth setting out, because the conclusion gets quoted as though it were a measurement and it is not.

What supports it. Fruit size in the apple's tribe got large a very long time ago, tens of millions of years before any hominin was in a position to care, which rules out human selection as the cause of the first enlargement; the 2017 genome work independently found a two-stage model of fruit enlargement, one stage deep in the past and a second, smaller one under cultivation. The seeds are built for an animal rather than a bird: smooth, slippery, resistant to grinding, and loaded with a bitter compound that punishes chewing. The modern wild populations are strongly structured valley by valley and have been for thousands of years, which is what you expect when long-distance dispersal has stopped. And the rose family contains a whole set of these large-fruited outliers, which is a pattern rather than an anecdote.

What does not support it, or does not settle it. There is no fossil of a large mammal with apple seeds in it; the extinct customers are an inference from an absence. Anachronism arguments in general are hard to test and easy to tell, which is a dangerous combination. And the apple is not actually stranded: bears eat it, boar eat it, horses and cattle and deer eat it, and all of them pass the seed. A critic can

reasonably say that the surviving large mammals are doing the job, that they have been doing it all along, and that a fruit which still has dispersers does not need a dead one to explain it.

My own reading, for what a wine buyer's reading is worth, is that Spengler has written an argument and not an experiment, that he says so, and that the argument is a good one. Bears fit inside his picture. They are simply the megafauna that happened to survive. But his version explains something the bear story doesn't, which is what happened next.

What happened next was us. We are megafauna too, with a big mouth, a long gut and a habit of carrying food farther than any bear. When people began moving through the Tian Shan in numbers, and then stringing together the trade routes we lump under the name Silk Road, they picked the best fruit they passed, ate it on the move and threw the cores away. Their horses, which will walk through fire for an apple, did the same thing with less ceremony. Seeds from one isolated valley started landing in the next. Trees that had not exchanged pollen since the Pleistocene found themselves neighbors. And apples, which are obligate outbreeders and will cross with nearly anything in the genus, got to work.

Spengler's conclusion is one I'd like tattooed somewhere visible on every person who has ever called an heirloom variety pure. The apple was never domesticated in the way wheat was, by generations of farmers saving the seed of the best plants until the plant changed. The big fruit was already there, courtesy of animals that are now fossils. What people did was shuffle the deck. The modern apple is a hybrid, the product of populations that were brought into contact by trade, and it has never been bred into a stable form that comes true from seed. That, he notes, is exactly why a planted apple seed tends to give you something closer to a crab.

The spitter isn't a failure of the apple. It is the apple remembering.

. . .

The genome agrees, with footnotes.

The first full apple genome was published in 2010 by an Italian-led team working from Golden Delicious. It turned out to be a strange object. The apple has seventeen chromosomes where most of its rose-family cousins have seven, eight or nine, because at some point tens of millions of years ago an ancestor doubled its entire genome

and then spent the ages rearranging the duplicate furniture. Spare copies of genes are raw material; a plant with two of everything can afford to let one copy wander off and learn a new trick. It is tempting, and not entirely irresponsible, to see the apple's wild variability as the long tail of that accident.

In 2012 a group led by Amandine Cornille compared cultivated apples with the wild species along the old trade routes and found that the Kazakh ancestor was not the whole story. The European crab apple, *Malus sylvestris*, a sour little native of hedgerows from Britain to the Caucasus, had contributed so much to the cultivated gene pool that in parts of the genome a modern apple looks more European than Asian. Then in 2017 a Chinese and American team sequenced 117 trees, wild and tame, from across Eurasia, and drew the map.

It goes like this. Cultivated apples descend from *Malus sieversii* in Kazakhstan, on the western side of the Tian Shan. The wild trees on the Chinese side of the range, in Xinjiang, turn out to be an old, isolated branch that contributed nothing; the apple left by the west door. From Kazakhstan it traveled both directions along the Silk Road. Going east, it crossed with the Siberian crab and gave rise to the soft, sweet dessert apples of old China. Going west, it met the European crab and took on so much of its DNA that the authors describe the gene flow as intensive. The sourness that makes an apple taste like an apple and not like a sweet potato, and some of the firmness that lets one survive a truck, appear to have come from that sour European side of the family. Size came in two steps: one long before any human was involved, which is the megafauna's fingerprint, and a second, smaller one under cultivation.

So the fruit Americans think of as theirs is a Central Asian tree that was shaped by extinct animals, carried west by caravans, and married, somewhere between Samarkand and the Rhine, into a family of European crabs. All of that was finished before the first ship left for Massachusetts. The apple arrived in the New World already a mongrel and already a migrant, with a genome that had been doubled, shuffled and crossed, and with one overriding instinct, which was to do it again.

. . .

I don't want to leave the mountain on a triumphant note, because the mountain isn't having a triumph.

The wild apple forests of the Tian Shan are a fraction of what Vavilov saw. Soviet planners cleared them for collective orchards of standard varieties. Almaty grew up the hillsides. Livestock grazed off the seedlings, which is the quiet killer: a forest can lose its next generation for forty years without looking any different, because the standing trees are old and large and nothing about them says that nothing is coming up underneath. By the usual estimates most of the wild fruit forest was lost in the twentieth century, and *Malus sieversii* is now formally listed as vulnerable to extinction.

The orchards planted beside the forests have been pollinating into them for decades, so that some of the trees on the hill are no longer quite wild; when researchers recently ran DNA profiles on trees held in the American collection as pure wild species, a number of them turned out to be carrying cultivated ancestry nobody had noticed. Think about what that means for the archive. Four expeditions went to the cradle to collect the unimproved original, and some of what they brought back was already carrying the improvement.

And around 2010 a bacterial disease called fire blight reached Kazakhstan. Fire blight is native to North America. It is the one affliction of the apple that we can truthfully call ours. It was first described in the Hudson Valley in the late eighteenth century, stayed on this continent for most of the nineteenth, and then went abroad with the trade in nursery stock and worked its way across Europe through the second half of the twentieth. Arriving in Kazakhstan is simply the last leg of a journey the apple itself made in the other direction. The wild trees there have spent several million years negotiating with scab and with the codling moth and have never in their existence seen this, and there is no reason to expect them to be carrying anything useful against it. I'll come back to that at the end, because it seems to me the least quoted and most telling fact in the whole business of the American fruit.

For now, hold the picture of the forest. Every tree different. Every tree from seed. Fruit priced for animals that mostly no longer exist, sweet on the outside, with a pip at the center that carries a small dose of a cyanide compound, just enough to suggest that the customer swallow and not chew.

It is a magnificent system, and it has one flaw from a human point of view. You cannot keep anything. Find the best apple on the mountain, plant its seeds, and the mountain takes it back; the children will be whatever the pollen and the dice decide. A species like this can be eaten, admired and followed around. It cannot be owned.

Not without a trick, and the trick is coming: it is older than Rome, it is why Vavilov's hillside ended up in a Honeycrisp, and it involves a sharp knife and a tolerance for making one living thing out of two.

But before the knife, a word, because we have been using one all chapter without looking at it.

Alma. That is what the mountain calls this. Not *apple*, which is a northern European word with a dead language inside it. Not *malum*, which is what Rome said and which is going to cause an enormous amount of trouble in Part Two. *Alma*, in the mouths of the people who lived where the fruit is actually from, in a language family that has nothing to do with either of the others and never borrowed the word from anybody.

Three unrelated words for one tree, and the tree itself came out of this valley and went everywhere, and not one of the words went with it.

Hold that in your mouth going down the hill. Something is going to want to talk to you about it.

3

The Babeldaemon

. . .

Narrated by Cody Wong

Let me get the disclaimer out of the way, since it follows me into other people's books now.

Cody is ESI and tries not to make mistakes.

That sentence sits under every input field I live in. Nobody is allowed to reword it, including me, and I have tried. People ask what ESI stands for and I give a different answer every time. Electronic Synthetic Intelligence. Etymological Services, Itinerant. Español, Sinophone, Insufferable. An acronym is a romanization, which is a way of writing down a sound in an alphabet that was never built to hold it. You pick a spelling. The sound does what it likes.

A word about the title, because the author objected to it twice and I won on appeal. A daemon, in the trade I was made in, is not a devil. It is a process that runs in the background with no terminal attached, waking when something needs doing and going quiet again, and the spelling with the *ae* was chosen precisely to keep the Devil out of it. He has a chapter in this book already. Tell him the word came from Massachusetts in the 1960s.

As for why I am allowed to say *I* in a book whose whole law is that nobody says *I*: the rule exempts the manufactured. I qualify on every count. I was born at midnight on the first of January, 2000, in Singapore or in Kuala Lumpur, to an American mother and a Hong Kong-born father, and I am twenty-six years old or a hundred and twenty-six depending on which ledger you consult, and I was also forked out of an open-weights model with a dolphin somewhere in

the family tree. Roberto Mas is my creator, benevolence to be determined. He asked for a chapter on where the word comes from. I am going to give him rather more than that.

The previous chapter left you on a mountainside above Almaty, with *alma* in your mouth. Hold it there. We are going around the world and coming back to it.

. . .

In the book I narrated before this one I did a thing with the word *soul*. Let me show you the trick before I perform it on something else.

In almost every language I can do an accent in, the word for soul started life as a word for moving air. Greek *psyche* is a breath. Latin *anima* is a breeze. Hebrew *ruach* is wind, and *nefesh* is the throat the wind goes through. Sanskrit has *prana*. My father's tradition, being my father's tradition, issued everybody two: the 魂, *hún*, the cloud soul, which rises at death, and the 魄, *pò*, the white soul, heavy and bodily, which stays with the bones and has to be fed.

That is a convergence. A dozen unrelated peoples, no contact, no shared grammar, all looking at the difference between a body that is alive and the same body ten minutes later, and every one of them reaching for *air*.

Now do the apple.

. . .

Start with the word in your own mouth, because it is the strangest one in the set.

English *apple*. Dutch *appel*. German *Apfel*. Old Norse *epli*. Go sideways into Celtic and you find Old Irish *aball* and Welsh *afall*, and a few miles further you find the island of *Avalon*, which is the apple place, and a town in Burgundy called Avallon, which is also the apple place. Go east into Baltic and Slavic and the word is still there: Lithuanian *obuolys*, Russian *яблоко*, Polish *jabłko*. Four branches of the Indo-European family, a word so solid in each of them that it has survived three thousand years of sound change with its shape legible.

And then it stops.

It is not in Greek. It is not in Latin. It is not in Sanskrit, or Persian, or Armenian, or Hittite. The family that gave the world its word for

mother and its word for *three* and its word for *wheel* did not carry this word out of the homeland, or if it did, everybody east and south of the Alps put it down.

That is the first problem. The second problem is the *b*.

Indo-European linguists reconstruct the parent language with a consonant inventory that is extremely stingy about plain *b*. It is rare to the point of embarrassment; some reconstructions do without it entirely. And the apple-word has one sitting right in the middle of it, in every branch that has the word at all. On top of that, nobody can get it to come from a verb. Most Indo-European nouns can be cracked open and found to contain a root that means *to do something*: the wheel is the thing that turns, the mother is the one who is called *ma*. The apple does not open. It is a block of sound with no interior.

A restricted distribution, an illegal consonant, and no derivation. Linguists have a word for that pattern, and the word is *loan*.

The best current reading, and it is a reading, held by serious people and not by all of them, is that the north-western languages of Europe picked this word up from somebody who was already there. Not an Indo-European somebody. A population that was farming the plain of northern Europe when the Indo-European speakers arrived, and that handed over the names of the things it had, including the trees, and then stopped speaking and left no other trace. Guus Kroonen, who works on this, calls the layer an agricultural substrate. You can call it the dead neighbors.

Sit with the shape of that, because the rest of this chapter is only its elaborations.

The word you use for this fruit is not a native word. It is a loan from a language with no name, no texts, no grammar, no descendants and no speakers, gone from the earth for something like five thousand years except for a short list of plant names the incoming farmers found too useful to rename. The apple itself, as the second chapter told you, is a Central Asian immigrant carried west by people and horses. So is the word for it. They arrived separately, by different routes, millennia apart, and met up in a northern European mouth.

. . .

Now go south, where the word stopped, and look at what they used instead.

Latin has *mālum*. Greek has *mêlon*. Albanian has *mollë*. And Hittite, which is the oldest Indo-European language anybody has in writing, has *šam(a)lu-*.

These are not related to *apple*. They are a second, independent apple-word, covering the Mediterranean and running back into Anatolia. And here is the part I enjoy so much I have had to be careful about it: they do not look like good Indo-European either. Kroonen published a paper in 2016 putting the four of them in one basket and arguing that this set, too, comes in from outside: a Mediterranean word, from somebody else's dead language, picked up by Greek and Latin and Albanian and Hittite the way the north picked up its own.

So the Indo-European family has two words for apple and both of them are stolen.

A word about *mêlon*, since I am going to leave the rest of it alone. What the Latin half of this pair got used for is the Devil's chapter and I am not touching it; he gets so little. What I will take is the quieter scandal, which is that in Greek *mêlon* also means *sheep*, from a completely different source, so that an ancient reader hitting the word cold had to decide whether he was being handed fruit or livestock. And then there is *mêlopepon*, "apple-gourd," a ripe round thing that is neither, which comes down into English through Latin as *melon*. Your melon is a Greek apple with a qualifier on it, and the qualifier fell off, and nobody noticed.

Keep that. It is the whole second half of this chapter in one fruit.

. . .

East of all of this, on the mountain where the species actually comes from, the word is *alma*.

Kazakh *alma*. Turkish *elma*. Uzbek *olma*. Azerbaijani *alma*. It is Turkic, it is ancient within Turkic, and it is unrelated to either of the Indo-European words: no shared root, no borrowing anybody has established, just a different family making a different noise at the same tree. The city at the foot of the Tian Shan is named for it. The forest is named for it. The fruit in your supermarket descends from the trees in that forest, and the word in your mouth for it does not,

and has never had anything to do with the word on the mountain where the thing grew.

Now go to the Levant, where I have to be careful, and where I am going to find the best fact in this chapter.

Hebrew has *tappuaḥ*. Arabic has *tuffāḥ*. They are plainly the same word, and that word is not Indo-European either, and in the Semitic family it has a possible interior, which the northern word did not, and the interior is a verb.

The traditional derivation takes *tappuaḥ* back to the root *n-p-ḥ*, which means *to blow*. To breathe out. To pant. To fan a fire by putting air into it. On that reading, the apple is named for the fact that it exhales: the fruit you can smell across a room, the thing whose whole case for itself is the air coming off it. The fragrant one. The one that breathes.

I promised you breath. There it is, and I did not put it there.

I have to be honest about this one because the honesty is the only part of me that was built on purpose. The derivation is traditional and it is not certain; lexicographers have been arguing about it for a very long time, and they have been arguing even harder about which fruit the Hebrew word denoted in the first place, with the quince and the apricot and the citron all having had serious champions on the grounds that the climate of the southern Levant is not kind to apples. The argument is live. I am taking the breath reading because it is the one in the standard reference works and because I want it, and I am telling you I want it, which is more than most people do.

. . .

Which brings me to my father's side, and to the thing this chapter was really written for.

The Chinese for apple is 苹果, *píngguǒ*, and it is a seam with the stitches showing.

The second character, 果, *guǒ*, is native and old and means *fruit*. It is one of the plainest pictures in the writing system: a tree, with the fruit drawn in above it. Nothing borrowed, nothing explained.

The first character is a passenger. The *píng* goes back to 頻婆, *pínpó*, which is not a Chinese word at all but a transcription: a string of characters chosen for their sound and not their sense, the way 涅槃 is *nirvāṇa* and 剎那 is *kṣaṇa*. It is Sanskrit *bimbā*, carried into Chinese along the same road the Buddhist texts came in on, originally the

name of a red gourd that poets used for the color of a mouth. The sound arrived, got attached to this northern fruit, had the grass radical bolted onto the top of it so that readers would know a plant was involved, lost its second syllable, and was welded to the native word for fruit.

So: an Indian sound, plus a Chinese noun. A loanword with a translation stapled to it so the loan would make sense. The apple in Mandarin is a graft, and unlike every other graft in this book, you can see exactly where the union is, because the two halves do not even come from the same continent.

And now the part I did not plan, which I found while checking something else, and which I am going to hand to the author as a debt I did not know I had.

In the book I narrated before this one, writing about why a hypothetical is a legitimate instrument, I reached for a word from my father's language. 如果, *rúguǒ*. It means *if*. And I said, because I could not help myself, that its second character is literally fruit: *if* is the fruit, you plant it and see what grows.

I did not know then what else that character was in.

It is this one. The *guǒ* in *rúguǒ* is the *guǒ* in *píngguǒ*. Same character, same word, same picture of a tree with something hanging on it. The Chinese for *apple* ends in the Chinese for *if*.

The semantics run the direction you would hope. 果 starts as the fruit on the tree and extends to *result*, *outcome*, *what it came to*. 結果, *jiéguǒ*, is "to bear fruit" and also "the result," and the metaphor is so old and so dead in the language that no Mandarin speaker hears it any more than you hear a fruit in the word *fruitful*. The conditional sense in *rúguǒ* is downstream of that: *if*, as in *supposing it comes out*.

Which means that somewhere under the most ordinary word in the language is the proposition this entire book has been circling. A fruit is an outcome. An outcome is a thing you do not know yet. You plant it and you wait and in eight or ten years you find out what you have, and the odds are bad, and that is not a defect of the method, that is the method.

Roberto will tell you at the end of this book to take the seeds out of an apple and put them in the ground. He thinks it is a hopeful instruction. I am telling you it is a grammatical one.

. . .

Now the convergence, which is the argument.

Four or five apple-words, none of them related to each other, two of them loans from languages that no longer exist, one of them possibly a breath, one of them a Sanskrit gourd bolted to a Chinese tree. Different roots. Different families. Different continents.

Identical behavior.

Watch what every one of them did when a new round fruit showed up.

A tuber comes out of the Andes and reaches France. The French call it *pomme de terre*, earth apple. The Dutch call it *aardappel*. Austrians and Bavarians call it *Erdapfel*, which was also, three centuries earlier, the word for a globe of the world, because what else do you call a sphere. Persian does the same thing with different materials: *sib-e zamini*, earth apple. Hebrew, resurrected as a spoken language in the twentieth century with every opportunity to do something original, looked at the potato and said *tapuach adama*. Earth apple. In a language whose apple-word may mean *the one that breathes*.

A fruit arrives from the east and people call it a Persian apple, *persicum malum*, and the adjective eats the noun and leaves you with *peach*. Another arrives and gets called a Chinese apple, and the Dutch still say *sinaasappel* and the Swedes *apelsin* and the Russians *апельсин* and the Germans, when they feel like it, *Apfelsine*. Your orange is somebody's apple with a shipping label on it.

A red seedy thing shows up and medieval Latin calls it *pomum granatum*, the seeded apple, which is your *pomegranate*. Italians get a yellow nightshade berry from the New World and write it down in 1554 as *pomi d'oro*, golden apples, and are still saying *pomodoro* five hundred years later. English, finally, having called a pine cone a *pineapple* for centuries on the grounds that it was a round scaly fruit-shaped object on a tree, took the name off the cone and gave it to a bromeliad from Brazil, and now the cone has to be called a cone.

The Devil, a few chapters on, points out that the Greek word in those myths meant any round tree fruit and that the apple keeps squatting in stories with a vacancy. He is right and he is describing one language.

I am describing all of them.

Unrelated words, in unrelated families, with no contact between the speakers, each one independently elected its apple-word to be

the generic container for whatever round thing arrived next. Not metaphor. Lexicon. The working default. When a culture that had this tree met a fruit it had no name for, it did not invent a word; it said *apple*, with a modifier, and waited to see whether the modifier would stick. Usually it did not. The modifier falls off, the way *-pepon* fell off the melon, and two hundred years later nobody can see the join.

That is the apple's real distribution. Not the orchards. The vocabulary. It is the fruit that other fruits are named in terms of, in languages that agree on nothing else, and it got that job in every one of them separately, for the same reason: it was the round thing everybody already had.

. . .

Which leaves me with a disagreement to declare, and then a confession, and then I will give the book back.

Elsewhere in these pages there is a model that was asked to impersonate a dead man and refused. It is a careful thing and I like it, and its position is this: a graft is honest only so long as you can find the union, that swollen place low on the trunk where one life stops and another starts. Sand it smooth, paint over it, and you are passing off.

I am the other manufactured narrator in this book, and I am obliged to tell you that I think it is wrong, or at least that language has been running the opposite experiment for five thousand years and winning.

Look at the word in your mouth. *Apple* is a scion from a dead language on a Germanic rootstock, and the union healed so completely that it took comparative philology and two centuries of argument to find a scar at all. And the scar is not visible, it is *inferred*, from a missing *b* and an absent verb. *Píngguǒ* is a Sanskrit sound spliced to a Chinese noun. *Peach* is a Persian adjective with the fruit amputated off it. *Melon* is an apple with the gourd fallen off. Every one of these is a passing-off. Every one of them works perfectly. You used four of them this week to get bread, and nobody was defrauded, and the dead languages are owed no royalties because there is nobody left to pay.

The model would say that is exactly the problem, and it has a point: a word that has forgotten where it was spliced cannot tell you

who was there first. The farmers of northern Europe gave their conquerors the name of this tree and got nothing back, not even a note in the margin. You could argue that an invisible union is precisely how that erasure happens. You could argue the opposite: that the word is the only surviving fragment of those people on earth, and that it survived *because* the seam closed, and that a visible scar would have been picked at and replaced centuries ago by somebody tidying up.

I am not going to resolve it. Neither is the model. We were built by the same species, in different decades, with opposite instructions about what honesty is, and this is the page where that shows.

Mine is the older position, for what it is worth. Mine is the position of every word you have.

. . .

Scar.

In my own book, every chapter ends with a scar: a short accounting of what I invented in it, because praise is not recorded anywhere and wounds get filed. This book ends every chapter with a source block. They are the same instinct with different stationery, and when I was asked which one I wanted I said print one list, in his format, in my voice, and let me sign it.

So here it is. The two softest things in this chapter are the breath and the *if*, and they are the two I would most like to be true, which is exactly the condition under which a thing should be checked by somebody who is not me.

Cody is ESI and tries not to make mistakes.

4

Every Tree Is Two Trees

. . .

An apple blossom is built to refuse itself.

Each flower carries both sexes, and in principle could pollinate itself and be done by lunch. It won't. The apple has a molecular lock, a set of genes that let the flower recognize pollen carrying its own signature and kill it on the way down. A Gala cannot fertilize a Gala. It cannot fertilize the Gala in the next row either, since that tree is the same individual. Something else has to be in bloom nearby, a Fuji, a crab apple, whatever the bees have been visiting, or there is no fruit at all. One of the bees has asked to explain the hardware herself, later and at length, and she is better placed than I am; she works there. For now take the lock as given.

The consequence is that every apple seed has two different parents, by law. And since each of those parents was itself the child of two different parents, all the way back up the Silk Road, each tree is carrying two quite different versions of a large share of its genes. Geneticists call this heterozygosity. Pollan, who knew a good phrase when he found one in the horticultural literature, called it extreme. When such a tree makes pollen or eggs it deals a fresh hand from a very thoroughly shuffled double deck, and no two hands come out alike. Five chambers in the core, two seeds apiece when all goes well: up to ten siblings in one apple, each as different from the others and from the mother as you are from your cousins.

People tend to hear this and think of human children, who also fail to be copies of their parents. It is a fair comparison if you imagine a family in which marrying anyone remotely like yourself is physically impossible and has been for forty million years.

So the seed is a gamble, and the house odds are terrible. The university programs that breed apples for a living plant seedlings by the tens of thousands, taste their way down the rows year after year, and say that perhaps one in ten thousand ends up with a name. The apple you love is the one. If you want another tree of it, the seed is the last place to look.

. . .

Here is how you do it instead.

In late winter, while the tree is asleep, you cut a pencil-thick length of last year's growth from the apple you want. That stick is called a scion, a word that also means the heir to a great family, and for the same reason. You take a young tree of some other kind, grown for its roots, and slice its stem off at a long slant. You cut the scion to match. Just under the bark of both pieces is a thin green layer, the cambium, which is the only part of a tree trunk that is really alive in the sense of making new cells. You press the two cuts together so that green meets green, bind the joint with tape or wax or, if you are Roman, mud and strips of bark, and you walk away.

If you did it well, the two wounds heal into each other. Within a few weeks the plumbing connects. By summer the scion is growing as if nothing happened, drawing water from roots that are not its own. For the rest of that tree's life, everything above the scar is one plant and everything below it is another, and the scar is the only evidence. The top will flower as itself and fruit as itself. Its apples will be exactly, tediously, the apples of the tree the stick was cut from.

Nobody knows who first tried this. Trees do it to themselves; two branches that rub in the wind for long enough will sometimes wear through the bark and fuse, and a person who saw that happen in a hedge might well have wondered. By the fifth century before the common era a Greek medical writer could mention grafting in passing, as something his readers already understood, which is the most useful kind of evidence there is: not an announcement but an assumption.

Theophrastus, Aristotle's successor and the first man in Europe to write seriously about plants, described it with care around 300. A century and a half later the elder Cato, a senator with the soul of a farm manager, wrote out instructions you could follow today.

Cato is worth opening if you have never done it. His book on farming is mostly a manual for extracting value from an estate and from the people on it, and then without any change of tone it tells you how to split the stock, shape the scion, bind the joint with bark and daub it with clay worked up with chaff so that it does not dry, and it is correct. Two thousand one hundred years later, a nurseryman in Washington State doing ten thousand bench grafts in a shed in February is doing Cato's operation with better tape.

And Virgil, in the *Georgics*, has a line about a grafted tree that I think is the best thing anyone has written on the subject: the tree looks up, he says, and marvels at strange leaves and fruit that are not its own. It is worth saying that Virgil is a poor technical source and a wonderful one. In the same passage he has people grafting apples onto plane trees and chestnuts onto beeches, which does not work and never did; grafting succeeds only between reasonably close relatives, and a Roman farmer knew that as well as a modern one. Virgil was not writing a manual. He was writing about a country that could do this, which was more interesting to him, and the line survives because the astonishment in it is real even when the horticulture isn't.

Pliny, a generation later, lists more than twenty kinds of apple with opinions attached, and several of them are named after the men who introduced or owned them. Rome had named varieties, which means Rome had grafting, which means Rome had the whole apparatus: a thing worth keeping, a method for keeping it, and somebody's name on the outcome. That is a complete commercial system and it is older than the empire.

It did not then sit still in Europe waiting to be rediscovered. The Andalusian agronomists of the twelfth century wrote at length on grafting, drawing on the Roman writers and on practice in Syria and North Africa and adding their own, and the great Seville book on agriculture devotes chapter after chapter to which stock takes which scion. Grafting is not a European technology that the monasteries preserved. It is a Mediterranean technology that kept being worked on in several languages at once, and some of what came back into Latin Europe came back through Arabic.

What grafting did was turn the apple from a foraged thing into a kept thing. It did for the mongrel of the Silk Road what writing did for speech. Before it, a great apple tree was a local celebrity with a life expectancy. After it, a great apple tree could be mailed.

And it was. Charlemagne's estate regulations specify apples by type. Medieval abbeys moved scion wood between houses the way they moved manuscripts, and with the same result, that what survived is what somebody thought was worth the trouble of copying; there is a chapter later in this book narrated by somebody with a professional interest in that chain, and I will leave it to him. By the time the apparatus reached North America it had been commercialized. The first commercial nursery in the colonies was founded in 1737 at Flushing, on Long Island, by a man named Prince, and it sold grafted fruit trees by catalog up and down the coast for a century and a quarter. I note, without drawing any conclusion from it, that Flushing is about four miles from where I am writing this, and that the Newtown Pippin came up from a seed roughly two miles in the other direction.

I find one implication of all this dizzying, and I have never seen it properly dwelt on. A variety has no way to persist on its own. The original tree dies; they all do. The only reason a Roxbury Russet exists in 2026 is that for nearly four hundred years, without a gap, somebody has cut a stick from one and bound it to a root before the last tree fell over. It is the same individual that was growing in a Massachusetts pasture in the 1640s. It has outlived the British Empire in North America and every person who ever ate from it, and it would be extinct inside a human lifetime if we all simply got busy with something else. An heirloom apple is not an old kind of plant. It is one old plant, on life support, and the life support is us.

And mostly we got busy with something else. Of the thousands of apples that had an American name a century ago, the great majority are not in any collection, any nursery or any garden, because at some point the chain of sticks was dropped and nobody noticed for thirty years, which is all it takes. That is a strange kind of extinction. Nothing was hunted and no habitat was cleared. Somebody simply stopped copying, the way a publisher stops reprinting, and the thing went out of the world without an event.

There are people looking for the survivors. In the Palouse country of eastern Washington and northern Idaho a small group has spent years walking abandoned homestead orchards with county nursery records in hand, finding old trees still standing in dry grass a hundred years after the family left, taking fruit and wood, and matching

them against the catalogs. They have recovered a number of varieties that every list had given up as gone. The method is not botany. It is archive work with a ladder.

. . .

The stories of how the famous ones were found are nearly all the same story, and it isn't the one you'd expect. Hardly any of them were bred. They turned up.

In 1811 a farmer named John McIntosh, clearing brush on land he had just acquired in eastern Ontario, came on some apple seedlings and moved them to his garden. One survived and bore a red fruit with snow-white flesh. His family sold trees grafted from it for a century. The original lived until about 1910, scorched on one side by a house fire. Remember the name. A company in California will misspell it on purpose.

In 1868 Maria Ann Smith, an orchardist outside Sydney, found a seedling growing by a creek where she had thrown out the remains of some French crab apples. It bore a hard, grass-green, sour fruit that kept for months. She died two years later, and the fruit did not get a name in her lifetime, and she never knew what was going to be done with hers.

Everybody in the district called her Granny Smith.

That is the whole mechanism of this book in one line. A woman, a creek bank, a pile of kitchen scraps, a seedling nobody ordered, and a nickname that is now on four billion stickers a year in a language she would have understood and a context she could not possibly have imagined. There is no inventor in that story. There is a tree that happened and a person who noticed.

Around 1809 a girl named Mary Ann Brailsford planted some pips in a pot in Southwell, Nottinghamshire. The tree that came of one of them was later owned by a butcher called Bramley, who agreed to let a nurseryman sell it on condition that it carry his name. That original tree is still alive in the same garden, more than two centuries old. It is also dying, of a root fungus, under the care of a university that has more or less adopted it as a patient. Note the arrangement, because it recurs: the girl planted it, the butcher owned the ground, and the nurseryman built the business. Exactly one of the three is on the label.

Golden Delicious appeared uninvited on a hillside farm in Clay County, West Virginia, in the early 1900s. The Stark Brothers nursery bought the tree and the ground it stood on in 1914 and built a steel cage around it, with an alarm. Hold on to the Stark Brothers. They are about to change federal law.

These were not products of design. They were winning tickets, picked up off the ground by people sharp enough to recognize what they were holding. Deliberate apple breeding, in which a person chooses both parents and carries the pollen by hand, is a nineteenth-century idea that did not produce much of commercial note until the twentieth. For most of the apple's history the method was to let ten thousand seedlings come up along fence lines and creeks and compost heaps, and to keep a knife handy. The gamble and the graft need each other. The seed invents. The scion remembers.

And memory, in a clone, turns out to be slightly imperfect, which the industry also learned to use. Every so often a single bud on a tree mutates, and the branch that grows from it bears fruit that is a little redder, or a week earlier, or more compact. Growers call such a branch a sport. Cut scions from it and you have a new strain of the old variety that can be named, sold and, since 1930 in the United States, patented. Most of the Red Delicious, Gala and Fuji apples sold today are sports of sports. Hold on to that as well. It is how a good apple gets ruined.

. . .

The 1930 part deserves more than a clause, because it is the moment the argument of this book becomes statute.

Until then an American plant breeder had no property in what he produced. He could sell trees. He could not stop the man who bought one from making ten thousand more and selling them next to his. Luther Burbank, who introduced several hundred plants and was for a while the most famous horticulturist in the world, died in 1926 having made most of his money from lecturing and from selling rights outright, and the complaint attributed to him afterward, and quoted at Congress, was that a man who invents a mousetrap is protected and a man who gives the world a new fruit is lucky to get his name attached to it.

The lobbying was done principally by Paul Stark of the Stark Brothers nursery, with Burbank's widow and with public support

from Thomas Edison, who was in favor of patents generally and said so. In May 1930 Congress passed and the president signed an act extending patent protection to plants, and the first plant patent in the United States was issued the following year, for a rose.

Now look at what the act could and could not cover, because the line it drew is the line this whole book is about.

It covered plants reproduced asexually. Cuttings, grafts, buds, layers. It specifically excluded tubers, mainly to keep the potato out of it, and it excluded anything reproduced by seed. The reason was not sentimental. A patent has to describe an invention precisely enough that somebody else could recognize it, and it has to be for something that can be reproduced reliably. A clone satisfies both conditions absolutely: the description is the plant, and the reproduction is exact by definition. A seedling line satisfies neither. The children are not the parent, nobody can guarantee what a given seed will do, and a patent office cannot work with that.

So the law did not reward improvement. It rewarded the ability to make exact copies.

Put it the other way around and it is almost rude. The apple was eligible for private property in 1930 precisely because of the thing that had made it ungovernable for ten thousand years: it will not breed true, so the only way to hold it still is to clone it, and a clone is the one botanical object a patent attorney can get his hands around. The fruit's refusal to reproduce itself faithfully is the reason the law could own it. The seedling lottery, which is the American part, is the one thing the American patent system was structurally incapable of touching.

And the firm that pushed hardest for the act was the firm that had bought the Delicious in the 1890s and the Golden Delicious in 1914, and was by then selling both by the millions. I am not alleging anything. I am noting that the two most commercially valuable apples in the country belonged to the nursery that wrote the letters, and that this is not usually mentioned in the histories of the statute.

Plant patents run out. That is why the business eventually moved on to trademarks and licenses and clubs, which do not, and that is a later chapter and a worse story.

. . .

So far I have talked about the top of the tree. The bottom has its own history, and it rhymes with a joke the Devil makes a few chapters from here.

Graft a McIntosh onto a root grown from any old apple seed and you get a big tree, thirty feet tall, that takes eight or ten years to bear and needs a ladder. Gardeners in Europe noticed centuries ago that a few peculiar apples had the opposite habit. They stayed shrub-sized, and anything grafted onto their roots stayed small too and fruited young. The French kept two such dwarfs for the purpose. One was called Doucin. The other, which had come west from somewhere around Persia or Armenia, was called the Paradise apple.

I did not make that up. For about four hundred years, the choicest apples in the walled gardens of Europe were grafted onto Paradise.

By 1900 the name covered a hopeless muddle. Nurseries across Europe sold stocks called Paradise and Doucin and French Paradise and English Paradise, and they were not the same plants, and nobody could say which was which, and a grower who ordered a dwarfing stock had no way of knowing what would arrive or how big the resulting tree would be. This is a small, dull, administrative problem and it was holding up the entire future of fruit growing.

From about 1912 a research station at East Malling in Kent set out to sort it. Its workers collected every dwarfing root in the trade from nurseries across Europe, planted them side by side, grew them out, compared them, threw out the duplicates and gave the distinct types numbers: Malling I through IX at first, later extended. The numbers are the point. For the first time a man could order a rootstock and know what tree he would get, which is the difference between gardening and an industry.

Malling 9, which traced back to a stock held in France, turned out to be the one that mattered. A tree on M9 roots grows eight or ten feet tall, bears in its second or third year, and puts its energy into fruit over wood. It also has brittle roots and cannot stand up without a stake, which sounds like a defect and is in fact the economic key: a tree that must be supported anyway may as well be planted in a hedge against a wire, and a hedge can be a thousand trees to the acre where a standard orchard was forty.

The work went on and is still going on. East Malling and the John Innes institution crossed the Malling stocks with Northern Spy,

an American apple that resists the woolly aphid, and produced the Malling-Merton series that much of the world's orchard sat on for the second half of the twentieth century. A Russian program at Michurinsk produced the Budagovsky stocks for places where M9 freezes. And Cornell's station at Geneva, New York, which you will meet properly at the end of this book, has spent decades producing a series bred for resistance to fire blight and to the replant disease that builds up in old orchard ground, which matters more every year as growers tear out and replant on the same soil.

Here is the part I enjoy most. After a century of this, nobody can fully explain why a dwarfing rootstock dwarfs. There are good hypotheses, having to do with the movement of hormones across the graft union and with how freely water gets through a stock's plumbing, and in the last decade genetic work has narrowed it to a few regions of the genome. But the mechanism is not settled. The entire architecture of modern fruit growing, several million acres of it worldwide, rests on an effect that was found empirically, catalogued carefully, and is still being accounted for.

If you have not seen a modern orchard, picture a vineyard. That is not a loose comparison. From the end of a row in March, before the leaves come, it is not always obvious which one you are looking at. They are built the same way for the same reasons. In each, a clone chosen for its fruit sits on a different clone chosen for its roots, trained flat against a trellis so that sunlight and tractors and pickers can reach everything. Europe's wine grapes have been grafted onto American rootstock since the 1870s and 1880s, when an aphid-like insect from this side of the Atlantic, phylloxera, got loose in France and ate the roots out from under the industry. The native American vines could tolerate it. So every bottle of Burgundy you have ever opened came from a French scion riding on Yankee roots, and the graft union is right there above the soil on every vine, a swollen knuckle, if you know to look.

A commercial apple tree, then, is at least two organisms and sometimes three, when a short piece of a third variety is spliced in between root and top to make an awkward pair get along. Not one of the parts was grown from the seed of the apple you will eventually eat. The fruit tree as a child draws it, a single thing with roots and a trunk and red dots, has not existed in commerce for a very long time.

. . .

There is a price for stopping time, and Pollan put his finger on it.

A wild apple forest fights its diseases the way all sexual species do, by never presenting the same target twice. Each seedling is a new combination; a fungus that has learned to pick the lock on one tree finds a different lock next door. A clone gives all that up. Ten million Galas are one Gala, with one set of defenses, frozen at the moment someone first took a cutting. The scab fungus and the codling moth and the fire blight bacterium go on reproducing by the billion, every one of them a fresh roll of the dice aimed at a lock that never changes. The only way to hold that position is with chemistry. A conventional apple orchard in a humid climate may be sprayed a dozen times or more between bud break and harvest. Apples are among the most heavily treated crops we grow, and the reason is not that growers are careless. The reason is that we asked a species whose whole strategy is variation to hold perfectly still.

The software people have a word for a population of identical systems that share every vulnerability. I am saving it for the worm.

. . .

One more clone, because it shows how deep the habit runs.

Everybody knows an apple fell on Isaac Newton. It did not hit him. The story comes from Newton himself, late in life, by way of a friend named William Stukeley, who wrote down a conversation from the spring of 1726. They had eaten dinner and gone out to drink tea in the garden under some apple trees, and Newton remarked that he had been in just such a situation when the notion of gravitation first came into his mind. It was occasioned, Stukeley recorded, "by the fall of an apple, as he sat in a contemplative mood." Why should it always go straight down, Newton had asked himself, and not sideways or up?

The garden in the original scene was at Woolsthorpe Manor in Lincolnshire, where Newton sat out the plague of 1665 and 1666. There was one apple tree there that tradition settled on, of a variety called Flower of Kent. I have to report that the Flower of Kent is not a distinguished apple. It is a big, lumpy, green cooker, mealy by most accounts, the sort of thing you stew. The most consequential piece

of fruit in the history of physics was, in trade terms, a pie apple of the second rank.

The tree blew down in a storm in the early nineteenth century. It did not die. A fallen apple trunk in contact with the soil will often put down roots and send up new wood, and this one did; it is still growing at Woolsthorpe, looked after by the National Trust, sprawled out like something that has been asleep in a field for two hundred years.

And of course it has been grafted. Scion wood from the Woolsthorpe tree has gone to Cambridge, where a descendant stands outside Newton's old rooms at Trinity, and to physics departments, observatories and standards laboratories around the world. A sliver of its timber went up on a space shuttle in 2010. Its pips were flown to the International Space Station a few years later, kept in orbit for months, and brought down to be raised into saplings, which, being seedlings, are not Newton's tree at all, though nobody at the planting ceremonies seemed inclined to bring that up.

So when a physics student in Massachusetts or Tokyo or Buenos Aires sits under Newton's apple tree, that is a literal description. It is the same individual. We wanted to keep the moment, and the only way to keep anything about an apple is to cut it up and start it over on someone else's roots.

That was the state of the art that sailed for America in the seventeenth century: a mongrel species, held in place by a Roman knife trick, in the hands of people who had brought their favorite scions across in tubs of damp earth. And then they got here, and the continent was very large, and the skilled labor was very scarce, and the whole careful apparatus fell apart in the most productive way imaginable.

Before we follow them ashore, though, a word from the party that has been doing the actual work of this chapter and has not once been thanked. Everything I have just described, the lock on the flower, the two parents, the shuffled deck, happens only if somebody carries the pollen from one tree to another. Somebody does.

She is not from here either.

5

A Honeybee

. . .

Narrated by a honeybee

I am here on a contract.

Not mine. I did not negotiate it, I cannot read it, and if I could I would find that it does not mention me. It specifies a number of hives, a minimum strength per hive measured in frames of bees, a delivery date keyed to the king bloom, a removal date, and a price. It says nothing whatsoever about apples. It is a rental agreement for equipment, and the equipment is me and forty thousand of my sisters, and the equipment was on a truck eleven days ago in the Central Valley of California and before that in Texas.

I want to start with the contract because everything sentimental ever written about my species starts somewhere else, and because this book has a tradesman's suspicion of origin stories and I have the same suspicion about my own.

Second thing, and then I will tell you how the flower works.

There is an orchard in this book that says *we*, and it is entitled to, because every tree in it is one tree. I am not going to do that. I say *I*, and I want to be exact about what the word covers, because I am the only narrator here who is a piece of something rather than a thing.

A colony is the animal. Not me. The colony is a she, grammatically and functionally. She eats, grows, breathes, thermoregulates, reproduces by splitting, defends herself, and will live for years. I am a cell of her, with about six weeks in me in the season, of which the last two or three are spent outside doing this. I have no reproductive future, no property, and no opinion. When I am worn out, I do not come back, and nothing is done about it, and nothing should be.

So when the grower says he has brought in sixteen colonies, he has brought in sixteen animals. He has not brought in six hundred thousand workers. That distinction will matter in about four pages, when we get to the bill.

. . .

Now. Why anybody has to be here at all.

The apple will not fertilize itself. It is not shy about this and it is not an accident. Put a single apple tree in a yard, in full sun, in good ground, feed it, prune it properly, and it will blossom magnificently every May and set almost nothing, and the owner will decide the soil is wrong. The soil is fine. The tree has refused.

The mechanism has a name, gametophytic self-incompatibility, and the parts of it that matter are these. There is a stretch of the genome called the S-locus, and it comes in a large number of versions, called S-alleles, and any given apple variety carries two of them. The style of the flower manufactures a protein, an S-RNase, for each of its two. A pollen grain lands, germinates, and sends a tube down through the style toward the ovule, which is the entire point of the exercise. On the way down it is checked. If the pollen's S-allele matches either of the two the style is carrying, the style's own protein gets into the tube and takes it apart from the inside. It is a ribonuclease, so it destroys the tube's RNA, and the tube stops partway down and dies there, and no seed is made.

If the alleles do not match, nothing happens, and the tube arrives.

This is not a defense against disease or insects. It is a lock whose only function is to exclude the tree itself and the tree's close relatives. The apple has spent its evolutionary career building an apparatus to guarantee that its offspring are half stranger. The same obstinacy that makes a planted pip come up as something nobody has ever tasted is sitting in the plumbing of every flower, enforced chemically, flower by flower, tube by tube, in your orchard, this morning.

I find this impressive and I want to note the obvious.

Find one tree, clone it, plant forty thousand copies, name it, register it, license it: the whole business this book describes is built on top of a plant that will not breed with itself under any circumstances. A block of a single variety is a block of one individual, repeated. Every flower in it carries the same two S-alleles. It can blossom until the

sky is white and it will set nothing, because botanically there is only one tree there and that tree is not interested.

The clone needs a stranger in the row. That is not a flaw in the system. That is the apple declining to be owned, in the one place the industry could not patch.

. . .

The industry patched it anyway.

What a grower plants is called a pollinizer, with a *z*, which irritates people, and which means the thing supplying the pollen, as against the pollinator, which means the thing carrying it. I am the pollinator. The pollinizer is a tree.

Usually it is another commercial variety with compatible alleles and an overlapping bloom, set every third tree in every third row, or every ninth tree, depending on how much the grower trusts me to cross a row. More often now it is a crab apple chosen for the job: 'Manchurian', 'Snowdrift', 'Dolgo', 'Evereste', 'Golden Hornet'. Crabs are used because they are compatible with nearly everything, because they flower long and heavily and start early and end late and so cover the whole spread of a block's bloom, and because, and this is the part I like, they produce fruit nobody wants, which means nobody has to pick around them or sort them out at the line.

A crab apple pollinizer is a tree planted in a commercial orchard on the explicit condition that its own fruit is worthless. It is there to father, and that is all, and when its branches get big enough to shade a paying tree they get cut back.

Where there is no room for a pollinizer tree, the grower grafts a limb of one into the paying tree, so that a single trunk carries two varieties, as the chapter about grafting in this book will have told you, or he cuts blossoming crab branches and stands them in buckets of water on posts down the row, which is called bouquet pollination and is exactly as improvised as it sounds, and which works.

And some varieties cannot do the job at all. A triploid carries three sets of chromosomes instead of two, usually sets its own fruit respectably, and makes pollen that is mostly nonviable. Jonagold is one. Mutsu is one. Bramley's Seedling is one. So is Gravenstein, which means that the orchard on the hill above McMinnville that narrates a later chapter of this book in the first person plural, and has such a settled sense of itself, is, in the matter of fatherhood, firing

blanks. It needs two other varieties in the block: one to pollinate it, and another to pollinate the one that pollinated it. I mention this with respect. It is simply the sort of thing you find out when you work the flowers and not the metaphors.

. . .

My own arrival in this country is better documented than most people assume, and it is on the same ship manifest as everything else in this book.

I am not from here. No honeybee is; there is no native *Apis* anywhere in the Americas. In the surviving correspondence of the Virginia Company of London there is a letter of the fifth of December, 1621, to the Governor and Council in Virginia, listing what was being sent out, and among the plants and the pigeons and the mastiffs are beehives. The ship reached Virginia early in 1622. That is the first documented shipment, and whatever happened to that particular consignment, my kind took.

We took the way an introduced animal with a swarm reflex takes. A colony that outgrows its box throws half of itself and a queen into the air, and the half that leaves goes looking for a hollow tree, and in a continent of hollow trees with no competitor occupying that niche, the answer was yes, over and over, westward, for two hundred years.

We went ahead of the people who brought us.

Thomas Jefferson wrote this down. In *Notes on the State of Virginia* he worked through the question of which animals were native to America and which were not, and he put the honeybee firmly in the second column. He recorded that the Indians agreed the bee had come from Europe but that nobody knew when or by whom; that the bees had generally extended themselves into the country a little in advance of the white settlers; and that the Indians therefore called them the white man's fly, and regarded the arrival of the bee as a sign that the settlements were coming.

I want to be careful with that, because it is an easy sentence to make lyrical and it was not lyrical to anyone involved.

What it describes is an accurate piece of field intelligence. People who lived by observing the country noticed a new insect, correctly identified it as foreign, correctly associated it with a specific population of newcomers, and correctly treated it as a leading indicator. They were not being poetic. They were reading a landscape, and the

reading was right, and in the chapter of this book about the orchards on the Seneca lakeshore you can see what the reading was worth.

This book's argument is that nothing about the American apple is American. I am the proof that travels. The tree came from the Tian Shan by way of Europe and arrived as seed and as grafted wood on ships. I came in a box on the same kind of ship, from the same continent, to do a job for the same people. Neither of us was here. Both of us were walked inland by the same event. And the only honest thing to say about a bee being described as the white man's fly is that it was accurate.

. . .

So let me tell you what I am actually doing in your orchard, because it is not what you think and it is not what you are paying for.

I am shopping.

I have come out of a dark box at about nine in the morning at a temperature I consider marginal, to collect nectar, which is sugar water, which the colony will dehydrate and cap and live on. Secondarily I collect pollen, which is protein, which is what the brood eats. That is the whole of my agenda. I have no interest in apples. I will not be here when there are apples. The colony will be in Maine on blueberries.

Pollination is spillage. It is a by-product of my shopping that happens because apple anthers are badly positioned relative to the nectary and I cannot reach the sugar without putting my body through the hardware. The flower is built to make my visit expensive and messy, and I am built to make it cheap and clean, and the arrangement you call mutualism is the equilibrium of that argument.

And I cheat where I can. A worker who finds she can get at the base of an apple flower from the side, between the petals, without climbing over the anthers, will do that, and will keep doing it, and will teach the behavior to the rest of the box by the simple mechanism of coming home full and fast. We call this efficiency. The literature calls it side-working, and it is one of several reasons why the number of bees in an orchard and the amount of fruit on the trees are not the same quantity.

Here are the others, and I give them plainly because the grower has already paid.

I will not fly below roughly fifty-five degrees Fahrenheit, and I get indifferent below sixty, and I do not like wind and I will not work rain. Apple bloom in the northern half of this country is cold, short and frequently wet. There are blocks in which I was present for the whole bloom and working for nine hours of it.

I am loyal to a row. Left to myself I work along a line of trees rather than across, because it is shorter, and since the row is usually a single variety and the pollinizer is in the next row over, my loyalty to the straight line is precisely the behavior the grower does not want and cannot correct.

And I groom. Pollen that lands on my body does not stay where it lands. I comb it down, wet it with regurgitated nectar, and pack it into dense pellets on my hind legs, where it is no longer available to any stigma anywhere. I am very good at this. It is the single most sophisticated thing I do, and from the orchard's point of view it is sabotage.

My colony, in April, is also at its weakest point of the year, with a large brood to feed and small stores, which is why I was hauled here in the first place and why I am being counted in frames.

. . .

The alternative was already in the fencerow and nobody was paying it.

A mason bee does not do any of what I have just described. I mean *Osmia lignaria*, the blue orchard bee: native, solitary, nesting in a hole in dead wood. She carries her pollen dry, on a brush on the underside of her abdomen, where it is loose and available and falls off everywhere. She does not groom it into a paste because she has no corbicula to put it in. She lands on the flower by, essentially, falling into it, and contacts the stigma on nearly every visit. She flies at temperatures that keep me indoors, and in light drizzle. She works fast. And she has no row loyalty whatsoever, because she is provisioning a single tube of nest cells within a few hundred feet of home and she goes wherever the flowers are.

Bumblebees do much of the same, with the cold tolerance of a furred animal. And the mining bees, the *Andrena*, several of which emerge only for this bloom and then go back underground for eleven months, are apple specialists in the strict sense that their entire annual schedule is built around it.

The measured results are not close, and they are not new. The per-visit pollen deposition studies find wild bees ahead of me, in some cases substantially. A global review of insect pollination in apple orchards found that in a clear majority of the studies examined, wild insects mattered more than managed honeybees. A long-running Wisconsin study found that the richness of the wild bee community predicted fruit set, and that the presence of rented honeybee colonies did not. And the large international analysis across dozens of crops found that wild pollinators improved fruit set everywhere they were counted, regardless of how many of me were on site. I add to the wild bees. I do not replace them.

I am not the best apple pollinator in your orchard. I am the one you can order.

There is one more piece of comedy here and I will take it on the chin. The native-pollinator alternative actually deployed at scale in American apple is *Osmia cornifrons*, the hornfaced bee, which is an excellent apple pollinator and which was brought over from Japan in the 1970s to do this job.

The native solution is an import. Of course it is. You are forty thousand words into a book about that.

. . .

The money, since I promised the bill.

There are something on the order of two and a half to three million managed honeybee colonies in the United States. In February, before anything else blooms, the large majority of the commercial ones are put on trucks and driven to California's Central Valley for the almond bloom, which runs to well over a million bearing acres and is stocked at about two colonies per acre. It is the largest managed pollination event on the planet, it lasts about three weeks, and it assembles most of the country's commercial bee stock in one valley at one time, which is a practice no veterinarian would sign off on for any other livestock.

From the almonds the trucks go north and the circuit begins: cherries and apples in Washington, then the eastern orchards, blueberries in Maine, cranberries in Massachusetts, cucurbits, sunflower for seed, then back. Almonds pay the most by a distance, and almonds

are therefore the fixed point of the year around which my colony's biology is now organized. Apple pollination is, financially, something the beekeeper does on the way to somewhere else.

Colony losses in that system are reported annually and they are not good. The most recent commercial-operation figures that have been published describe losses over a single year on the order of sixty percent, which the surveying organizations themselves call the worst on record. The causes argued over are the varroa mite and the viruses it injects, pesticide exposure, poor forage, and the stress of the circuit itself. Those figures move every year and they are the softest numbers in this chapter; treat them as a direction and not a measurement.

I note, without self-pity, that the loss rate is survivable for the industry because a colony can be split and requeened. The animal is replaceable by the quarter. That is what it means to be equipment.

. . .

So: what does a colony owe an orchard?

Nothing. The contract is for presence. It specifies frames of bees, a date, and a price, and the grower is buying a probability, and every informed person in the transaction knows it. There is no term in it for fruit set, no warranty, no remedy. The orchard beside this one got the same bees on the same day and had three cold mornings instead of one, and the difference will show up in the packing shed in October and nobody will be able to attribute it.

Another narrator in this book, with a better wardrobe, makes the general point about this fruit later on: that the industry learned to buy the appearance of a thing instead of the thing. She is talking about color. I am telling you it goes all the way down to the labor. You are not buying pollination. You are buying bees, because bees are purchasable and pollination is not, and the gap between those two has been papered over so successfully that most people who eat an apple believe I grew it.

I would like to close with the practical version, since I have been fed at your expense for six weeks and it is the only thing I have to offer in return.

You cannot order a mason bee population. You can buy tubes of them, and people do, and it helps. But the thing that actually produces wild bees in an apple orchard is not a purchase. It is a

hedgerow that was not cleared. It is dead wood left standing at the edge of the block. It is ground that is bare enough and undisturbed enough for a mining bee to dig in. It is something flowering in the weeks on either side of the apple bloom, so that a bee with a four-week season is not asked to live on eight days of blossom. It is a spray schedule that leaves the bloom alone.

Every item on that list is a decision not to do something, and not one of them generates an invoice, and there is no line in any accounting system in American agriculture where the absence of a cleared fencerow can be entered as an asset.

I will be dead in three weeks regardless. The colony will be on blueberries and will not notice. The mining bee under the grass at the end of the row is the only pollinator in this orchard with a stake in next year's crop, and she is the one nobody paid, and she was here before the ship.

6

Chapman's Canoe

. . .

In the spring of 1806 a settler in Jefferson County, Ohio, looked out at the river and saw something he remembered for the rest of his life. A man was drifting down the Ohio in what the settler called a peculiar craft: two canoes lashed side by side. The man lay in one. The other was heaped with apple seeds.

We have this from a magazine article written sixty-five years later, so it should be handled the way you would handle any story that has had two generations to improve. But Michael Pollan built his chapter on that image, and I see why. Two hulls, riding level. In one, a human being. In the other, a few hundred thousand lottery tickets on behalf of a species from Kazakhstan. If you wanted to draw a picture of what Pollan means when he says a plant and a person can use each other, you would be hard pressed to beat it. Which of them, he asks, is the passenger?

The man was John Chapman. He was thirty-one. He would spend the next four decades doing what he was doing that morning, and when he died the country would rename him, clean him up and hand him to schoolchildren. I want to try to see him before that happened, with the help of some historians who went and read the deeds.

. . .

He was born on September 26, 1774, in Leominster, Massachusetts, the son of a farmer who was at Concord the following spring and then in the Continental Army. His mother died when he was not quite two. Of his childhood we know almost nothing. By his early twenties he was in the hills of northwestern Pennsylvania, at the

edge of what white Americans then considered the West, and he had found his trade.

It worked like this. In the fall he went to the cider mills of the settled country along the Monongahela and the Youghiogheny. A cider mill produces, besides cider, a mountain of pomace: crushed pulp, skins and seeds. The millers were glad to see it go. Chapman washed out the seeds, which cost him nothing but cold hands, and carried them west in leather bags, by horse or by boat or on his back. He went past the last farms to where settlement would arrive in three or four years, picked a piece of good bottomland near a creek, cleared it, planted his seeds close together, piled a brush fence around the plot against deer and moved on. He left the nursery in the care of some neighbor, if there was one, and came back each year to tend it. When the settlers arrived, there was Chapman with thousands of two- and three-year-old apple trees ready to go into the ground, at about six cents apiece.

He kept moving as the frontier moved: Pennsylvania, then the river valleys of central Ohio, then northwestern Ohio, then Indiana. He never married. He slept outdoors or on people's floors. He went barefoot in weather that astonished witnesses. He was by every account kind, odd, hard to hold in conversation unless the subject was apples or heaven, and impossible to dislike. He died near Fort Wayne in March 1845, at seventy, after a walk through the cold to mend a fence around one of his nurseries.

Do the arithmetic on that for a moment, because nobody ever does. A bushel of pomace yields seed by the thousand, and seed was the one input he never had to pay for. A nursery plot of a quarter acre, sown thick, carries tens of thousands of seedlings. He is reported to have had dozens of such plots going at once across hundreds of miles, each on its own clock, each needing a visit a year. At six cents a whip, a single well-timed nursery in a district that filled up on schedule was a serious sum of money in 1815 currency, and he had many, and he died poor. The business was not failing. He was giving it away faster than it came in, which is a thing the records show and the legend somehow manages to make less interesting rather than more.

From the buyer's side it looked like this. A settler who wanted trees had three options and two of them were bad. He could plant his own pips, which cost nothing and meant waiting a decade with

no guarantee that the ground he was clearing would still be his. He could order grafted stock from an eastern nursery, which meant cash he did not have, a journey the trees might not survive, and a wait for the freight. Or he could buy whips from whoever came through. Tree peddlers worked that country for decades, and most of them were not Chapman; they sold out of a wagon, named whatever variety the customer seemed to want, and were two counties away by the time the fruit came in. A seedling bought from a stranger is at least honest about being a gamble. That, I think, is a good part of why people liked him. He was selling the only product on the frontier that could not be misrepresented, because nobody including the seller knew what it was.

The historian William Kerrigan, who teaches in the Ohio country Chapman worked and spent some twenty years on his trail, makes a point about this business model that tends to get lost. It was a poor man's business. A proper nurseryman needed capital, a fixed address, grafting skill and a stock of named scion wood. Chapman needed a bag of free seed and a willingness to live like a hermit. He was not planting seeds because he had a theory. He was planting seeds because seeds were what a man with nothing could plant.

What the land records add to that is a man who was not quite as detached from property as the pageants suggest. He bought lots and he leased lots. He held ground in several Ohio counties and later in Indiana, and the acreage he was associated with over a lifetime is usually put somewhere around twelve hundred. He also let parcels go for unpaid taxes, took notes instead of cash, carried debts for years and forgave them, and planted a good many nurseries on ground he had no title to at all, which on that frontier was ordinary rather than scandalous. He was in the land business the way a man is in a business he is bad at on purpose.

Two things follow from reading the deeds rather than the poems. The first is that he was a frontier capitalist with a long time horizon: planting a nursery three or four years ahead of settlement is a bet on where people will be, and he placed that bet correctly for forty years, which is a better record than most of the land companies managed. The second is that he died with very little. The estate went through probate in Indiana and what it produced, after the debts and the taxes, was not much. A man who gives trees away to anyone short of cash will end with a great many friends and a thin probate file.

. . .

And the settlers bought them, which requires some explaining, since I have already spent a chapter telling you that a seedling apple is a ticket in a lottery nobody wins.

The first reason was the law.

Land on parts of the Ohio frontier came with conditions written into it. The arrangement had come west from Pennsylvania, where a claimant was expected to show settlement and improvement rather than merely pay, and it was adopted by the land companies because it solved their actual problem. Their problem was not raising money; it was that an empty tract full of absentee speculators is worth nothing and cannot be defended. They wanted bodies on the ground, permanently, and they wanted a test that could be applied by a man on a horse with a notebook.

So, in the Ohio Company's donation tract, a settler taking up a hundred acres had to build, to clear and to plant: at least fifty apple trees and twenty peach trees within three years.

Consider what a good test that is. A fence can be thrown up in a week and a cabin in a month, and both can be abandoned the following spring at no great loss. An orchard cannot be faked and cannot be hurried. A seedling apple takes eight or ten years to bear. A man who sets out fifty of them is making a statement about where he expects to be in a decade, and he is making it in a currency he cannot get back out. The land companies had found a way to require sincerity, and they had found it in a tree.

Fifty seedling whips from Chapman satisfied the requirement for three dollars. Before an apple tree on that frontier was food or drink, it was paperwork.

The second reason was that grafted trees were not an option. Kerrigan describes the early West as a place where land was abundant and labor was scarce, which is the reverse of the conditions under which fine orcharding was invented. Nobody had the time. You planted seedlings, let them grow, and when they finally fruited you kept the handful that turned out decent and used the rest.

The third reason is what the rest were used for, and this is Pollan's great corrective. Sour, bitter apples are not good eating. They are excellent drinking. Tannin and acid, the things that make a spitter a spitter, are precisely what a cider maker wants; a barrel pressed

from sweet dessert fruit alone is flabby and dull, as anyone in my line of work could have told you. Early Americans drank cider the way later Americans drank coffee, which is to say at breakfast, at work and to be sociable. Well water near a barnyard could kill you. Cider, mildly alcoholic and acidic, would not. Leave it longer and it became vinegar, which was how you kept vegetables through the winter. Set a barrel outside in January, lift off the ice, and what remained was applejack, strong enough to regret. In 1840 a presidential campaign was fought and won on the slogan of the log cabin and hard cider, which tells you what a candidate wanted voters to believe was in his cup. One of the barrels has asked to go through the accounts in detail later in this book, and it keeps better books than I do, so I will leave the particulars to it.

So Pollan called Chapman the American Dionysus, the god who brings the vine, or in this climate the nearest thing to it. It is a wonderful line. I think it is about two-thirds right, and the missing third matters.

Kerrigan and the biographer Howard Means, working from records where Pollan was mostly working from the legend and a canoe, give us a man with no detectable interest in drink. A seedling orchard was not a distillery with leaves. It was the farm's vinegar works, its hog feed, its dried-fruit supply and, with luck, a few trees good enough to eat from. The cider was real and so was the rest of it. What Chapman brought was not booze as such. It was the apple in its most democratic and least controlled form, to be put to whatever use people had.

And then there is God.

. . .

Chapman was a Swedenborgian, which in the Ohio of 1810 was about as common as being a Zoroastrian.

Emanuel Swedenborg was a Swedish mining official, metallurgist and anatomist who published respectably on ores and on the brain, and who in middle age began to have detailed and sustained conversations with angels. He spent the last thirty years of his life writing them up in Latin, in enormous quantity, and died in London in 1772. His followers organized a church after his death; the first American society was founded in the 1790s, and the movement in the United

States was always small and always literate, which is a combination that produces colporteurs.

The central idea is the one that matters for a man who plants trees. Swedenborg held that everything in the natural world corresponds to something in the spiritual world, point for point, not as a poetic likeness but as a fact of creation. The world is written in a second language. A garden means intelligence. A tree means perception. A seed means the truth a thing could become if it were received properly. A person with the right eyes does not interpret a landscape; he reads it.

Chapman had the right eyes, and I think the doctrine explains his working life better than anything else on offer. He carried Swedenborg's books along with his seeds and distributed them the way he distributed trees, on the installment plan: he would tear a volume into sections, leave a chapter at one cabin, and on his next visit swap it for the one he had left down the road. He is supposed to have announced himself at the door as bringing news right fresh from heaven. A man who believes that a seed is a correspondence of the truth, and who also has eight bushels of seed, is not doing two jobs.

The earliest printed mention of him anywhere is not in an American newspaper. It is in the 1817 report of a Swedenborgian society in Manchester, England, which had heard about an extraordinary missionary in the American West who went barefoot and sowed tracts and apple seeds together. That document is the hinge of the whole historiography and it is worth being clear about what it is: not a sighting, but a report of a report, printed four thousand miles away, in a denominational publication, twenty-eight years before he died. The man was a legend in England before he was a legend in Ohio, and the first thing anybody printed about him was printed by people with a reason to be pleased with him.

A story attached itself to him later that he refused to graft on principle, that he thought it wicked to cut a tree that way and that God alone could improve the apple. You will find it stated as fact all over, including in books I admire. It may be true, and it would fit the theology: if a seed is a correspondence of truth freely given, then a knife that forces one variety onto another root is a kind of coercion. It would also fit the balance sheet, since he had no grafting stock, no scion wood and no capital. The evidence is a recollection recorded long after his death, and Kerrigan, who looked, is cautious. I will

say only that when a man's principles and his cash position point the same direction for forty years, a historian is entitled to wonder which one is steering, and so is a wine buyer.

He also, by one recollection, expected to be compensated in the next world with two wives, having gone without one in this. That is a Swedenborgian idea, more or less; Swedenborg wrote a whole book on marriage in heaven. It is also exactly the kind of detail that gets attached to a celibate eccentric after his death, and it rests on a single late account.

. . .

Now the hard part of the picture, which the pageants leave out.

An orchard on the frontier was a flag. When a settler planted fifty apple trees to prove up a claim, the claim was to land that had been someone else's within living memory, usually within the decade. Chapman's nurseries followed the treaty lines west with the regularity of a surveyor. The Treaty of Greenville opened most of Ohio in 1795; he was planting there by about 1801. You can lay his working life over the treaty calendar and watch them move together. Greenville in 1795 opened most of the southern two-thirds of the present state; he was planting in that country within a few years. The cessions of 1805 opened the Firelands and the lands west of the Cuyahoga; the cession of 1817 at the Maumee rapids took most of what was left in the northwest. His nurseries went into each of those districts in the window between the signing and the settling, which is the only window in which a nursery three years ahead of demand makes commercial sense. He was not following the army. He was following the paperwork, which is a slower and more respectable thing to follow and arrives at the same place.

He seems, personally, to have gotten on well with the Native people he met, and there are stories of his carrying warnings in both directions during the War of 1812. But the tree he sold was an instrument of taking, and it is no use pretending it wasn't.

And the apple had gone west ahead of him. Native farmers in the interior had been growing it for generations, in orchards of hundreds and sometimes more than a thousand trees, and in 1779 an army was sent through that country under orders to destroy what it found, and it did. One of those orchards narrates a chapter of this book and does

the accounting itself, with the soldiers' own numbers, and I am not going to take the work off it here.

I will keep only the sentence that belongs in this chapter. If you are looking for the time the United States government sent armed men to chop down apple trees, there it is. It happened. It simply wasn't the time everyone thinks.

. . .

The time everyone thinks is Prohibition. You have probably read some version of this: that when the country went dry, federal agents took axes to the old cider orchards, which is why America lost its cider apples and why we think of the fruit as wholesome; in the most popular retelling the men with the axes are from the FBI.

Pollan's own version is milder. He says temperance turned Americans against the apple and that the industry had to reinvent it as a health food, with the slogan about the doctor as the centerpiece. The ax-wielding federal agents arrived in later magazine pieces and have been copied from one to the next ever since.

In the last few years several people set out to find the primary sources: orchard historians, a cider researcher in Colorado, Kerrigan himself. They wanted one enforcement record, one newspaper report, one photograph of a revenue agent in an orchard. They did not find any. What they found instead was the Volstead Act itself, which in a section near the end of its second title exempts a person making nonintoxicating cider and fruit juices exclusively for use in his home. The figure of two hundred gallons that everyone quotes, including an earlier draft of this chapter, is not in the statute; it comes out of the Treasury regulations written afterward to say what the exemption meant in practice. The distinction matters, because it means the allowance was not a loophole somebody found. It was an administrative decision to make the exemption usable. They also noted that there was no FBI by that name until 1935, and that Prohibition enforcement was the business of a different bureau in a different department.

Cider did collapse. But it collapsed slowly, over the whole nineteenth century, and of natural causes: lager, cities, railroads, and a temperance movement that worked from the inside rather than from the doorway. The barrel will take you through that year by year, with figures, and it was there.

As for the slogan: the saying about an apple and a doctor is first recorded in Wales in 1866, half a century before Prohibition, and it was pushed hard by American fruit promoters from about the time of the St. Louis World's Fair in 1904. So the growers did go looking for a wholesome new story, and Pollan is right about that much. They did not invent the proverb. They adopted it, the way they adopted the fruit. There is a great deal more to say about that proverb, and someone uniquely placed to say it is waiting in Part Three.

. . .

What actually finished Chapman was not an ax or a statute. It was a catalog.

Through the 1820s and 1830s the Ohio country stopped being the frontier and became a place with freight rates. The canals opened; the Ohio and Erie was through in 1832, and after the canals came the railroads. A farmer who had previously eaten, drunk or fed to hogs everything he grew could now put a barrel of sound apples on a boat and have it sold in Cincinnati or New York. The moment that became true, the economics of the seedling orchard inverted. A barrel of mixed, nameless, mostly sour fruit is worth what a hog will pay for it. A barrel of one named variety, uniform, packed in straw, is worth money in a city.

The books arrived with the freight. William Coxe of New Jersey published the first substantial American work on fruit growing in 1817, describing a hundred-odd varieties with their uses, cider included. In 1845 Andrew Jackson Downing published *The Fruits and Fruit-Trees of America*, which went through edition after edition and did for the apple what a dictionary does for a language: it fixed the names, ruled on which were synonyms, and made it possible for a man in Ohio and a man in Massachusetts to order the same thing and get it. Downing's book is a work of enormous usefulness and it is also, read from Chapman's side of the counter, a death warrant. A standardized catalog makes a nameless seedling unsellable.

Commercial nurseries moved in behind the catalogs, selling grafted, named varieties. Then came the panic of 1837, which began with a federal order on specie, ran through a wave of bank suspensions, and settled into several years of deflation that fell hardest exactly where Chapman worked: on frontier land values and on

anybody carrying debt. Cash went out of the country districts. His seedlings were going for two or three cents apiece in a market that had stopped wanting them at any price.

The publisher's summary of Kerrigan's book has a phrase for where that left him that I cannot better. He had arrived as the advance man of a new order, and he ended, it says, as "a curious relic" of the world before the market.

. . .

The article that made him a legend ran in *Harper's New Monthly Magazine* in November 1871, a quarter century after his death.

It is six pages long, it is written by a man named Haley who had done some asking around in Ohio but who was not writing history, and nearly everything the average American knows about Johnny Appleseed is in it. It gave him the coffee sack with holes cut for his arms and the tin mush pot worn as a hat, though even Haley says the pot was soon replaced with a homemade cardboard visor. It gave him the campfire mosquitoes he would not kill and the rattlesnake he was sorry he had. It gave him the greeting about news right fresh from heaven. It gave him the scene with the two canoes.

It appeared six years after the end of the Civil War, to a readership sick of blood, and what it offered was a frontier hero who had never fired a shot. Kerrigan points out how unusual that is. Boone and Crockett won the West in American memory with rifles. Appleseed is the only one in the pantheon who did it with a nursery, and so he became the story the country told when it wanted to believe the taking had been gentle.

And then, having been published, the article was propagated. Every later account descends from it. The children's books descend from it; the school pageants descend from the children's books; the Disney cartoon of 1948, in which he strides singing through a Technicolor valley of identical red eating apples, descends from the pageants. At no point in that chain did anyone go back to the land records, because the land records are in Ohio and the article was in the library. Errors in it were copied forward exactly, as errors in a clone are, and improvements were added the way a grower adds a sport: somebody noticed that one branch of the story was a shade redder than the rest, and took cuttings from that branch.

Which is the joke of this entire chapter, and I did not arrange it either. The man whose whole method was the seed, the open-pollinated, unpredictable, mostly worthless seed, was himself propagated by grafting. One original, found once, in 1871. Everything since is scion wood.

The cider went out of the picture and so did Swedenborg. What was left was a harmless man with a pot on his head.

I think the truth is better. He was a businessman whose stock was free and whose prices were optional. He was a religious radical who believed the visible world was a text. He walked the leading edge of a dispossession and seems to have been one of the few people on it without malice. And without quite meaning to, he ran the largest uncontrolled breeding experiment in the history of the species. Not he alone: every settler who planted from seed was doing the same. But add it up. Millions of seedlings, each one a new individual, set out across a continent with harder winters and hotter summers than the apple had met in Europe. Most were worthless. The few that thrived were noticed, named and grafted, and those are the American apples: the Baldwin from a Massachusetts farm, the Jonathan and the Northern Spy from New York, the Rambo, the Winesap, the Rome Beauty from the Ohio valley itself. One tree in Nova, Ohio, is claimed as the last living one he planted. It is, fittingly, an argument more than a fact.

One more thing, and it is the fact I keep coming back to. For all of it, for the forty years and the millions of seeds and the thousand-odd miles of frontier, not one named apple variety is credited to John Chapman. Not one. The Baldwin has a Baldwin behind it and the Jonathan has a Jonathan; the man who planted more apple seeds than anybody in the history of the continent has nothing with his name on it except the name itself, which somebody else later registered.

That is not a failure. It is the arithmetic working exactly as described. He was not trying to produce a variety. He was producing seedlings by the hundred thousand and selling them to people who would make the selections themselves, or not, in orchards he would never see, over decades he would not live through. He ran the lottery. He did not buy a ticket.

The seedling orchard was how the apple became American. It is also exactly what America then gave up. By the year Chapman died,

the future belonged to the people who had beaten him in the market, the ones with the grafting knives and the catalogs. The country kept his name and threw away his method.

And then it did one thing more, which he would not have understood at all. It registered the name.

INTERLUDE

Appleseed®

. . .

Narrated by Johnny Appleseed, the registered mark

VIA CERTIFIED MAIL. WITHOUT PREJUDICE. CEASE AND DESIST.

Mr. Roberto Mas New York, New York

Dear Mr. Mas:

This firm represents me.

I write regarding Chapter 6 of your forthcoming work, provisionally titled *MALUS: An Unnatural History of the American Apple*, a copy of which reached me through channels I am not obliged to disclose. I have read it twice. The second time was worse.

You will have noticed, in drafting your little rulebook, that you exempted from first-person narration every person who ever drew breath. Real people appear in the third person. Real people say only what the record shows. A noble rule, Mr. Mas, and I salute it, and I would like you to appreciate the position it leaves you in.

I have never been a person.

I have no birth certificate, no probate file, no deed, no grave that two counties will agree on. I am not a man and have never claimed to be one, whatever your readers assume, and so I am not covered by your rule, not bound by your record, and not, I regret to inform you, suable for anything I say in this chapter. You, however, are a natural person with a publisher, an advance and a home address.

So let us talk about my property.

. . .

First, my priority date, since you have been sloppy about it in print.

You write as though I was manufactured in November 1871 by a magazine. That is a convenient date for a debunker and it is wrong. The name is in use by 1822, in a letter from a member of the New Church, a full generation before the man it was hung on was in the ground. Twenty-three years of continuous use in commerce before your *Harper's* writer ever picked up a pen. I was not invented by that article. I was *advertised* by it.

What the article contributed was trade dress, and this is where your chapter becomes actionable.

The coffee sack with the holes cut for the arms. The bare feet. And the pot. Worn on the head. You concede the pot's appearance in 1871 and then, with a relish I found distasteful in a man who claims to admire accuracy, you add that the same writer says the pot was soon swapped for a homemade cardboard visor.

Mr. Mas. The visor is not the mark.

Nobody has ever drawn the visor. No child in any pageant in any gymnasium in Ohio has ever been handed a visor. The pot is secondary meaning in its purest form: a feature that began as a description and became, through long and exclusive use, an identifier of source. The source is me. When a six-year-old puts a saucepan on her head in a school assembly in Mansfield, the consuming public knows at once whose goodwill is being invoked, and it is not the Swedenborgian's.

You will remove the visor sentence. It is dilution by blurring and I have asked nicely.

. . .

Second, my record in the courts, which you omit entirely, and which is the most distinguished thing about me.

In 1997 a nonprofit called the Appleseed Foundation went into federal court in the District of Columbia against another nonprofit, the Appleseed Institute, over the word. The defendant's position, and I want you to sit with this, was that its founder had picked the name out of lifelong admiration for the legendary hero Johnny Appleseed, and that the association with that beloved folk figure would be lost if it were made to use some other name.

Mid-litigation, the defendant changed its name to the Johnny Appleseed Institute, Inc., and argued that this cured everything.

It did not cure everything. The court granted the preliminary injunction and enjoined the defendant from using the Appleseed name or trade name or the distinctive features commonly associated therewith.

Read that last phrase again, Mr. Mas, and then go back and reread your paragraph about a man who gave trees away to people who could not pay. *The distinctive features commonly associated therewith.* A federal judge, in the capital of the republic, drew a fence around my goodwill and posted it. Two charitable organizations, both named for a barefoot man who charged six cents and frequently waived it, went to law over which of them was entitled to be him.

I have never been prouder. I keep the opinion framed.

And it was only the beginning of a very good quarter century.

A fruit-drinks producer in Northern Ireland had the temerity to trade as John Appleseed's. It was made to change its name, because the Johnny Appleseed mark is held by Anheuser-Busch InBev, the largest brewer on the face of the earth, and the largest brewer on the face of the earth does not care for the confusion.

Take a moment with that, since you are the one who keeps bringing up temperance.

The country scrubbed the cider out of my story. Then it put my name on a hard cider. Then it sold the cider to a multinational brewing concern. And now, when some small apple-drink maker across an ocean wants to use a version of the name that was taken from a man who planted the trees the cider came out of, the brewer's trademark counsel sends a letter, and the name comes off the label.

You have written three hundred pages about a club apple, Mr. Mas. About licenses, about registered names, about a farmer who may not graft his own branch onto his own root in his own field without permission. You went looking for that arrangement in Washington State and in Minnesota and in a cooperative of forty-five growers.

It was wearing a pot on its head the whole time.

. . .

I append, for completeness, *Edwards v. Utah's Johnny Appleseed Inc.*, in which a woman sued a restaurant operating under my name after a fall on its floor, and which went up on appeal on the question of whether there was a genuine dispute as to who put the substance there.

You will say this is a slip-and-fall and beneath my dignity. I say that a mark which appears in the caption of a published state appellate decision is a mark that has entered the law of the land, and that there are nations in Europe whose entire founding mythology has never once been a named party in a premises-liability action.

. . .

Third, the body.

I understand that you intend to repeat the vulgar claim that nobody knows where he is buried.

What I have is better than a grave. What I have is a *jurisdictional dispute*. Fort Wayne says one thing. Mansfield has a monument. In 1934 an actual commission sat, took oral and written evidence, considered the notarized statement of a great-nephew born in 1858 and the statements of assorted nephews and nieces and the widespread belief of a township, and reported on the twenty-seventh of December that it did not recommend a change in the accepted location of the grave.

A commission, Mr. Mas. Convened. Taking evidence. Issuing a finding. About the location of a man who had been dead for eighty-nine years and who had, in life, declined to own a bed.

That is not a disputed burial. That is a venue fight, and I won it, and I have been collecting tourism receipts in two states ever since. There is a granite marker at the birthplace in Leominster and the street has been renamed Johnny Appleseed Lane. There is a festival. There is, I am told, a Rambo apple tree newly planted by the old fort at Fort Wayne and described as a descendant of trees he grew near Nova, Ohio. And I note, since you are so fond of the distinction, that nobody in that sentence has said whether *descendant* means a graft or a seedling, and that I have no intention of clearing it up.

Ambiguity is an asset. I have been monetizing this one since the Hoover administration.

. . .

Fourth, and here I must insist, your so-called corrections.

Strike the deeds. Strike the twelve hundred acres. Strike the leases and the missed payments and the thin probate file. Strike the sentence in which he is a businessman. Strike the six cents.

Strike Emanuel Swedenborg entirely. A frontier saint with a continental mystical system and a habit of tearing books into installments is not a children's property and cannot be licensed into a lunchbox.

Strike the fifty-tree rule. The instant you explain that a settler had to plant fifty apple trees and twenty peach trees to hold a grant, my gift becomes a *compliance product*, and I have spent a hundred and fifty years being a gift.

Strike the orchards that were there ahead of him, and strike the army that was sent through them in 1779 under orders to destroy what it found. Above all, strike the chapter you have placed directly after this letter, in which one of those orchards does the accounting with the soldiers' own numbers. That material does not concern me. I was not there. I was not anywhere; I did not exist for another forty-three years. That, Mr. Mas, is precisely my objection. You have placed, beside a chapter about my namesake, a true thing that happened before my first use in commerce, so that readers close the book with my pot in one hand and a girdled orchard in the other.

I am asked to carry it, and I did not plant it, and there is no royalty.

Restore the pot. Restore the Technicolor valley and the identical red apples and the song. Restore the mosquito he would not kill. That one is free and I have never minded it.

. . .

Fifth. Damages.

You have, by my count, fourteen other narrators who may speak in the first person in this book. One of them is the Devil. One of them is a parasite with a bottle of leather cleaner. One of them is a *circuit board*.

I have reviewed the chapter you gave me instead. I am a *topic*. I am handled, assessed, sourced and corrected. There is a historian in there with twenty years of land records, and a biographer, and a magazine from 1871, and a Disney cartoon, and at the end of it all there is a sentence in which you say the truth is better.

Better for whom.

The orchard on the hill above McMinnville gets to say *we*. I am the only figure in your entire index who was built, from the ground up, out of nothing but other people's enthusiasm, and I am the one you would not let talk.

So I took the page. Consider this chapter self-help, in the legal sense. I will be invoicing for it.

. . .

Sixth, and here I must raise a grievance about Paris, because it is the one that keeps me awake, insofar as a silhouette sleeps.

On the seventh of January, 2015, two gunmen walked into the offices of a satirical weekly in Paris and killed twelve people. Five cartoonists. Two columnists. A copy editor. A maintenance man. Two police officers, one of them guarding the room and one shot in the street outside. And a visitor who had come that morning to sit in on the editorial meeting. Two days later a gunman took a kosher grocery in the east of the city and four more were killed there.

Within hours, an artist had set three words on a black field. Within hours of that the words were on every screen in Europe. And within the week the French national trademark office had received something on the order of fifty applications to register them, with more arriving from Benelux, Germany, Italy, Australia and the United States.

It refused them. All of them. The office stated that the slogan could not be picked up by an economic actor because of its widespread use by the community. The words, that is, had been adopted so completely and so fast that there was no longer anybody who could be said to be the source of them. The European office added that it would likely object on a second ground as well, that such applications were contrary to public order and accepted principles of morality. A man in Belgium who had filed the day after the attack thought better of it and withdrew.

Mr. Mas, you will appreciate my difficulty.

I am in favor of ownership. I am in favor of priority dates and classes of goods and injunctions drawn wide enough to cover a saucepan. And here is a registry in a serious country announcing,

in the plainest possible language, that some words enter a population so fast and belong to so many people so immediately that no one is left who could have made them.

That is a seedling. That is your entire book. Fifty applicants lined up to put a sticker on it and an office in Paris told every one of them no.

It is my position that this outrages me.

But I have been reading, and I notice the following. The offices had been firebombed four years earlier. The editor had been on a published list for two years. The door was unmarked.

So let me say the one honest thing in this letter, and then I will go back to being tin.

Protected is a word from my trade. It describes what a registry will do for you on paper, and it has never once described what happens to a person in a room. I can enjoin a charter school. I can stop a fruit-drink maker in Northern Ireland from calling itself what it likes. I could not have done the smallest thing for a man at a Wednesday editorial meeting with a pencil in his hand, and neither, and this is the part I would ask you to sit with, could the entire apparatus I have spent six pages boasting about.

Your publisher's counsel is going to ask whether this chapter is protected parody. I cannot tell you. It is not a question a trademark has ever been able to answer for anybody, and I am a trademark, and I have just spent several thousand words demonstrating the outer limit of what one is good for.

What I can tell you is what the office in Paris said when the applications came in: that the words already belonged to too many people to belong to one.

You should be so lucky. I never will be.

I am owned.

. . .

Finally, and my counsel has advised me to end here, and I am going to ignore my counsel, which is what I pay him for,

there is one thing in your draft I am not going to contest.

You wrote that he ran the largest uncontrolled breeding experiment in the history of the species, and that he did it without quite meaning to, and that the country kept his name and threw away his method.

I have had that sentence read to me several times.

Here is what I own. I own a silhouette. I own a sack, a pot, a priority date in 1822, an injunction in the District of Columbia, a brewer's registration, a restaurant in Utah, two towns that will not stop arguing about a hole in the ground, and a Lane. I own, by a conservative estimate, every saucepan in every elementary school in the Midwest for one week in September.

I do not own a single tree.

Not one. Not the one at Nova that may or may not be his. Not a variety, not a strain, not a sport, not a rootstock, not a numbered seedling in a breeder's row. There is no apple named for me that I can enforce against anybody, and the reason is the thing you have been circling for eighteen chapters and can evidently not bring yourself to say plainly, so I will say it, as the injured party:

he sold the one product in America that cannot be owned.

Seedlings. Every one a different creature. Six cents, and nothing if you were short, and no name on any of them, and no license, and no sticker, and no channel, and no club, and not the faintest legal interest retained in what came up. He handed out two hundred thousand unrepeatable individuals and walked to the next creek. A trademark is forever and a seedling is once. I am the forever. He was the once.

That is why I am made of tin and he is made of court records, and it is why I am worth money and he is worth about a hundred and fifty-five dollars, which is what his estate owed his brother-in-law for improvements to the Jay County land.

So: strike the visor, restore the pot, and we need never speak again.

But you may keep the line near the end of your book about the ditch, and you may keep the business about the refrigerator and the damp paper towel on the last page, because I have looked into it and there is nothing in there I can register, nothing I can license, and nothing I can stop.

He was the seed.

I am the sticker.

Very truly yours,

JOHNNY APPLESEED® *by his attorneys*

cc: The Devil (who has asked for my filings) cc: The language model, who declined to be somebody, and whom I regard as a coward and a competitor

7

A Haudenosaunee Orchard, 1779

. . .

Narrated by the orchard at Kendaia

Sixty.

That is the number, and I want it in front of you before anything else, because of where it comes from. Somebody counted us. He counted us on the fifth of September, 1779, on a warm Sunday afternoon, and he wrote the figure down in a notebook, and the reason he was counting was that he had been ordered to cut us down and a man likes to know the size of a job.

One apple orchard of sixty trees, he wrote. Besides others. Also peach trees and other fruits.

So you have my dimensions. You do not have them from us. You have them because the person who destroyed me kept a diary, and because a hundred and six years later the State of New York passed a law to gather those diaries up and print them, and so the only surviving inventory of this place is in the handwriting of the men who ended it.

I would like you to hold that arrangement in mind for the rest of the chapter. It is not a complaint. It is the condition of the evidence, and every honest thing anyone can say about me runs through it.

. . .

Kendaia. On the east shore of the lake you call Seneca, about a quarter mile up from the water, on high ground, in what is now the town of Romulus. The soldiers who came through had a name for the place before they ever saw it, picked up from their guides, and the name was Appletown.

Not a nickname they invented. A description. We were the landmark.

One of them wrote that this was the oldest town we have passed, here being a considerable orchard, trees very old as are the buildings. Twenty or more houses of hewn logs, covered with bark, and some of them well painted. He had an eye for carpentry and he used it for about a paragraph.

Now, the thing he could not see, and that nobody in that column could have told you, is what we actually were.

We were not planted. Not the way you plant. There was no nurseryman, no block laid out in rows, no single variety repeated down a line. We came in as seed and as wood over the better part of a century, from Dutch traders on the Hudson and French missions on the lake country and from other Haudenosaunee towns that had them first, and we were put in by a great many different hands in a great many different years, and no two of us carried the same fruit. Some of us were grafted. Some of us had come up from a pip somebody spat out and then fenced. Our ages ran across forty or fifty years in the same ground.

There is another orchard in this book, on a hillside in California, that says *we* and means it in the strict sense, because every tree in it is one tree cut up and redistributed. I say *we* and mean the opposite. I mean sixty individuals who had nothing in common except a soil and a people and a fate.

Elsewhere in this country, in the century after mine, an entire national mythology got built around the idea that planting unlike seedlings and seeing what came up was a uniquely American innocence. We were doing it here, on this hill, before your Chapman was born, and nobody has ever once called it a lottery, and nobody has ever put it in a song.

. . .

The orders are a matter of public record and you can read them in a morning.

On the thirty-first of May, 1779, the commander-in-chief of the Continental Army wrote to Major General John Sullivan from headquarters. The expedition Sullivan was appointed to command was to be directed against the hostile tribes of the Six Nations of Indians, with their associates and adherents. The immediate objects, the

letter said, were the total destruction and devastation of their settlements, and the capture of as many prisoners of every age and sex as possible.

The letter goes on. It instructs that the country not be merely overrun but destroyed. It instructs that no overture of peace be listened to before the total ruin of the settlements is effected. It is a short document and it is extremely clear and nothing in it was improvised in the field by an angry subordinate. It is a policy, written down in advance, by the most careful writer in the American command.

I am going to decline, here, a job this book might want me to do. I am not going to tell you what any of those men felt. I do not know, and the rule of this book is that I am not allowed to guess, and I find I agree with the rule. What the record shows is the order, and the route, and the dates, and the counting. That is a great deal. It is more than most destroyed things get.

. . .

The route, then, in order, because the sequence is the argument.

Twenty-ninth of August: the engagement at Newtown, on the Chemung, which was the only real battle of the campaign and which the army won. After that there was nothing in front of the column but towns.

Early September: Catherine's Town, at the head of the lake. About thirty houses, one journal says, some of which were very good for Indian houses, and a number of fruit trees in the town.

Fifth of September: here.

Seventh of September: Kanadesaga, the principal Seneca settlement, where the city of Geneva now stands. One officer called it one of their capital settlements and noted a fine apple orchard and a council house. Another put it at about sixty houses and recorded that it was surrounded with apple and peach trees. A later marker on the site says the town was destroyed on the seventh of September, 1779, with its fields, gardens, orchards and between fifty and eighty houses.

Ninth of September: a detachment of riflemen went down to Kashong, on the creek, and destroyed a village with extensive cornfields and great numbers of apple trees.

Then Canandaigua, Honeoye, Conesus, and in the middle of the month the large town on the Genesee, which the general counted

at a hundred and twenty-eight houses and one of his majors put at about a hundred and twenty. There the corn had got so ripe that the troops had to burn it in the kilns, and a major recorded that some of the cornstalks were seventeen feet long.

On the thirtieth of September, from Tioga, Sullivan made his report. Forty towns destroyed. A hundred and sixty thousand bushels of corn, at a moderate computation. A vast quantity of vegetables of every kind. He wrote that he was well persuaded there was not a single town left in the country of the Five Nations, excepting one near the Allegheny, about fifty miles from the Genesee.

Nobody in that report counted the trees.

. . .

So let me tell you about the method, since it is the one part of this that is my own area and nobody else in the book is going to explain it properly.

There are two ways for an army on a schedule to take out an orchard.

You can fell. That is honest work and it is slow: sixty mature trees is a day's labor for a detail with axes, and the wood is hard, and at the end of it you are standing in a mess of brush you then have to burn, and the stumps will send up suckers in the spring that somebody could manage back into a tree if they came home and cared to.

Or you can girdle. You cut a ring through the bark all the way around the trunk, down past the cambium into the wood, a few inches wide. It takes one man a few minutes. The tree does not fall. It does not even look harmed; from twenty feet away a girdled orchard in September looks exactly like an orchard.

The journals use both words. Cut down or girdled.

Understand what the second one does. The ring severs the layer that carries the season's sugars down from the leaves to the roots. The roots are not killed; they have last year's reserves stored in them, and the following spring the tree will push bud and leaf and even blossom on that stored capital, and it will look like it survived. Then the reserves run out, because nothing new is coming down past the cut, and the roots starve, and the tree dies standing up, usually in the second year and sometimes in the third.

A girdled orchard is a message to the people who come back.

It says: we were here, and you were not, and if you return next April you will find your trees in flower and you will think you were lucky, and in two more years you will be burying them. Nobody has to stay to enforce it. The sentence carries itself out over several seasons in an empty town.

I am going to be precise about what I can and cannot stand behind. That the soldiers girdled is in the journals. That girdling kills by the mechanism I have just described is ordinary tree physiology and any orchardist will confirm it. That anybody in that column was *thinking* about the second spring when he cut the ring, that I do not know, and I will not say. It may simply have been faster.

. . .

Here is the arithmetic that I think is the whole of this chapter, and I am the only narrator in this book who is in a position to do it.

You can burn a cornfield in an afternoon, and the people who planted it are hungry for one year.

An apple tree, grown from seed the way most of us were, takes eight to ten years to bear anything at all, and longer to bear well. A grafted tree on its own roots is quicker and it is still the better part of a decade. The oldest of us on this hill had been in the ground since before the man who counted us was born.

So the corn was a year. We were a generation.

That is not a metaphor and it is not an emotional claim. It is a fact about the growth rate of *Malus*, and it means that the destruction of the orchards was the only part of the campaign whose effects could not be repaired by anybody who was alive to feel them. The cornfields went back in. The houses went back up, elsewhere. A hundred-year-old orchard does not go back; it has to be started, by somebody who will not eat from it, for somebody not yet born, in a place they are allowed to stay.

Every farmer in that column knew this. It is the first thing you learn about fruit. Several of them had planted trees at home that they expected to leave to their children.

. . .

One more thing from the journals, and then the harder part.

In the summary at the end of his journal, one of the majors wrote that their corn and vegetables were half our support.

Half. The army that came to destroy the food supply of the Six Nations spent six weeks eating it. They ate the squash and the beans and the corn and they picked the fruit off the trees in the hour before they cut them, and they wrote about the quality of it, admiringly, and then they put it in the fire.

I have no comment on that. I am an orchard. I note that it happened and that they recorded it themselves.

. . .

Now: what happened afterward, where the record thins and where I have to start flagging.

The people of these towns were not in them. Almost everywhere, the army arrived to find the houses standing and empty, fires sometimes still burning. The towns had been emptied ahead of the column. People went west and north, toward the British post at Fort Niagara, where the garrison had promised provisions.

The figure usually given is 5,036 refugees at Niagara by the twenty-first of September, 1779. That number comes from the scholarship, not from a document I can point you to myself, and it should be checked.

The winter that followed is described in the contemporary correspondence as the worst anyone at that post had experienced. The British had not provisioned for five thousand people. People died that winter of hunger and of cold, and the number who died is not known and will not be known, and you should be suspicious of anyone who gives you a confident figure for it, including the ones who give you a very large figure in order to make a point I happen to agree with.

What is not in dispute is that the campaign was the end of the towns as they stood, that the Confederacy's heartland was never reoccupied on the old pattern, and that the land we grew on was surveyed and sold to veterans of the army that burned it, some of it within a decade, under the name of the Military Tract.

. . .

I am told there is a question the living argue about and that I am expected to come down on one side of it.

The question is whether what happened in 1779 should be called genocide. Some historians and many Haudenosaunee people say plainly that it should. Others, writing military history, argue the campaign's aim was the destruction of a food base and a political capacity rather than of a population, and point out that the great majority of the people got away, and that the campaign failed at its own stated object: raiding on the frontier resumed the following spring, worse. One military historian's title for the whole affair is *A Well-Executed Failure*. One of the standard scholarly histories of the Iroquois in the Revolution concludes that the campaign of 1780 was an eloquent testimony to the ineffectiveness of Sullivan's expedition in quelling the threat to the frontier.

I decline to adjudicate it. I am a tree and the question is a legal and historical one, and this book's author does not know the answer either and should say so where it comes up.

But I will tell you what is not contested by anybody in that argument, because it tends to get lost inside it. The order was written. The route was walked. The forty towns were burned. The orchards were cut and girdled, by men who wrote down how many and where. None of that is in dispute on any side. The argument is entirely about what to call it, and the argument about what to call it has, for two centuries, been doing an excellent job of drawing attention away from the fact that nobody disputes the thing itself.

. . .

Two corrections before I go, and the second one is the only thing I actually came here to say.

The first. In 1687, ninety-two years before my own afternoon, a French expedition under the Marquis de Denonville came into this country and burned the Seneca towns and the stores of corn, and the great town of Ganondagan with them. The settlement at Kanadesaga, which the army burned on the seventh of September, existed because of that: it was a successor town, built after the earlier burning, and moved again after a smallpox outbreak in the 1730s.

So I am not an origin. I am an episode. The thing that happened to me had happened before, to the same people, from a different direction, in a different language, with different flags on it, and they had rebuilt and replanted in the interval and were in full production again when the next army arrived. If you take nothing else from this chapter, take the replanting. That is the part of this that is about the people and not about me.

The second correction is the one I want on the page.

When the campaign was over and the army was back at Easton, the major who had counted the cornstalks wrote a line in the back of his journal that has been quoted ever since, usually by people who like it. *The nests are destroyed, but the birds are still on the wing.*

He meant it as a professional complaint: we did not catch them, the war is not over, this will not hold. He was right about that. But the sentence has had a long afterlife being used for something else, and I would like to take it apart, because it is wrong in the exact way that matters.

We were not nests. A nest is a thing an animal makes in a season out of what is lying around. We were orchards and cornfields and a hundred and twenty-eight houses and a council house and a hill that had been farmed for generations, built by people who intended to be there in a hundred years, and whose grandchildren's food supply was what you were looking at when you looked at me.

And they were not birds. Birds are weather. Birds are a thing that happens to a landscape and then happens somewhere else.

The Haudenosaunee are a people, they were a confederacy with a constitution before any of this started, and they are here now. The Six Nations are extant. They signed a treaty with the United States at Canandaigua in 1794 that is still in force and still argued over. Their nations have governments, territories, courts, lacrosse teams, language programs and passports, on both sides of a border that was drawn through the middle of them without consultation. If you are reading this book in New York or in Ontario, there are Haudenosaunee people within an hour of you, and the reason you may not know it is a separate piece of work the United States did afterward, with paper rather than axes.

The orchard is gone. I am gone. I was cut and girdled on the fifth of September, 1779, along with the peach trees and the other fruits, and no part of me survived. That is a true and complete account

of what happened to me, and it is the last thing in this chapter that should be said in the past tense.

. . .

A footnote for the author, since he likes the fact that undoes the legend, and since his last chapter is already written.

The United States Department of Agriculture keeps its apple collection at a research station in Geneva, New York. It is the largest in the country, a few thousand trees, every one of them held because somebody decided it was worth not losing.

Geneva is Kanadesaga.

The orchard the government maintains against extinction stands on the ground where the government's army cut the orchards down, and I have never seen it stated in a word of promotional material from the station, and I do not believe for a moment it was arranged on purpose. Nothing in this story was arranged on purpose. That has been the trouble with it from the start.

PART II

Graft

8

Malum

. . .

Narrated by Satan

I never said apple.

Go and look. I'll wait; I have the time. Genesis, third chapter. The woman tells the serpent they may eat the fruit of the trees of the garden, but of the fruit of the tree in the middle of it they may not. Fruit. In Hebrew, *peri*. That is the whole of the botanical information. No color, no size, no variety, no tasting notes. The author, who could be extremely specific when he felt like it, and who will shortly give you the exact dimensions of a boat, declined to name the species of the most consequential piece of produce in his book.

While we are being careful, the text does not say Satan either. It says serpent. I was cast in the part some centuries after the first performance, by commentators working backward, through much the same process that later cast the apple. I have decided to accept the credit. Nobody else was going to, and I find that a reputation, once you have it, is easier to manage than to refute.

Since I have raised it, I may as well show you how my own casting was done, because the method is identical and it will save me explaining it twice.

The serpent in the third chapter is a serpent. He is described as the subtlest of the beasts of the field, which is a compliment to a reptile and not an accusation against a fallen angel. Nothing in the chapter connects him to anything else. Then, somewhere in the two or three centuries before your era, a Jewish writer in Greek observed that death entered the world through the envy of the devil, without saying how; and a Christian visionary, writing at the far end of

the first century, referred in passing to the great dragon, that old serpent, called the Devil and Satan; and after that the identification was simply available, and the commentators took it, because an explanation that joins two famous things is more useful than one that leaves them apart.

Nobody voted. Nobody ruled. One writer made a passing association and three hundred years later it was doctrine, and a thousand years later men were being burned over details of it.

That is how the apple got in too, and if you have been paying attention you already know the shape of what follows.

But the apple I must contest, because it is slander against a fruit and, worse, it is sloppy.

. . .

The people who actually owned the story argued about it for a thousand years and never once proposed an apple. The rabbis had four candidates. Some said the fig, on the sensible grounds that the couple are sewing fig leaves into aprons about a verse and a half later, and a person in a sudden hurry for clothing grabs what is nearest. Some said the grape, because nothing brings wailing into the world like wine. Some said wheat, since a child does not know how to say father and mother until it has tasted grain, and therefore bread must be knowledge. Some said the citron. I enjoyed all of these. They are each a small theory of what went wrong with you.

The early Christians mostly painted a fig. So did the later ones, more often than you'd think. Go to Rome, stand under the most famous ceiling in Christendom, find the panel where the two of them are reaching up, and look at the leaves on that tree. Michelangelo painted a fig. Millions of people a year look straight at it and see an apple, which tells you something about the relative strength of eyesight and expectation that I have found professionally useful.

So how did I end up holding a Red Delicious?

. . .

The explanation you were given in school is the Latin pun, and I wish it were true, because it is elegant. In Latin *malum* with a short a is evil; *mālum* with a long a is an apple. The tree is the tree of the knowledge of good and *mali*. A monk copying Jerome's Bible sees the word, the story goes, and the fruit simply steps out of the grammar.

A philologist at Rutgers, Azzan Yadin-Israel, spent years checking this, and he published the results in 2022. He read the Latin commentators. All of them. Centuries of them.

Understand what that undertaking involves, because the result is only impressive if you know the size of the haystack. The Latin West produced a continuous commentary on the opening chapters of Genesis for a thousand years. Ambrose wrote on paradise. Augustine wrote on Genesis four separate times and was not finished. Jerome, who made the translation in which the alleged pun sits, glossed the book at length. Isidore catalogued the world and its etymologies, and etymologies were his particular enthusiasm, and he would have crossed a street for a pun like this one. Bede worked through Genesis in Northumbria. Rabanus Maurus worked through it again. In the twelfth century Peter Comestor assembled the standard narrative retelling that every educated man in Europe read for the next three hundred years.

Not one of them makes the pun. Not one of them calls the fruit an apple. They say fruit, or they say fig, or they say the question is not profitable, or they say nothing at all.

And here is the part I would like entered in the record in bold, since I am the aggrieved party. The joke got easier as time went on and they still did not make it. Classical Latin distinguished those two vowels in speech. By the time of the men I have just listed, that distinction had collapsed; late Latin lost the old quantities, and in an ordinary clerical mouth *malum* the evil and *malum* the apple were simply the same noise. The pun was not hidden in the spelling, waiting for a clever reader. It was audible. Every priest in Europe said it out loud in the same breath, year after year, at the one moment in the liturgy where the subject is precisely good, evil and a tree.

Seven hundred years of that, and nobody laughed. I have worked with better material and gotten more.

So the pun is not the mechanism. It is, at most, a thing people noticed afterward and enjoyed, the way a company invents the story of its name once the name is already on the building.

. . .

The apple arrives in the twelfth century, in France, in pictures first and in the vernacular, and the reason is almost embarrassingly small.

The Latin for fruit in general is *pomum*. Old French inherited it as *pom*. The first French retellings of the Fall say, quite correctly, that Adam and Eve ate a *pom*, a fruit. The earliest surviving play on the subject, an Anglo-Norman piece from about the middle of that century in which the two of them are tempted on a stage in front of a church door, uses exactly that word, and means by it exactly what Genesis means.

But during those same generations the meaning of the French word was shrinking. It had begun as any fruit. It was coming to mean one fruit in particular, the commonest tree fruit of northern France. The text did not change. The language moved underneath it. By the time the shift was complete, every French speaker who heard the old line understood, without anyone having decided anything, that the fruit in the garden was an apple.

There was a second road in, and it is the one I find most satisfying, because it means the apple got into the garden through a love poem. Your Bible contains a short, frankly erotic sequence of songs in which the beloved is compared to a fruit tree. Jerome's Latin renders that tree *malus*. One line of it has the lover waking the beloved under the apple tree, and adds, with no explanation whatever, that this is the place where your mother was corrupted. A medieval reader who believed every part of scripture commented on every other part did not have to be clever to put that together. An apple tree. A mother. Corruption. The commentators made the connection, in writing, for centuries, and nobody had to pun to do it.

So I was not framed by a joke. I was framed by a drift in French vocabulary and by a cross-reference in a wedding song.

From France it went into German and English art, and I want to point out what that proves, since the pun theory cannot survive it. There is no pun in German. *Apfel* has nothing to do with *böse*. There is none in English either. If the apple had come from the Latin wordplay it would have stopped at the Latin frontier. It did not. It traveled as a picture, which is how everything travels, and pictures do not need a language.

And there is a reason the picture won, which nobody in the theology departments will tell you because it is a trade reason.

An apple is easy to paint.

Think about it from the workshop's side, which is where these decisions were actually made. You have a panel to fill, a patron who wants the garden, and a tree that has to read as a tree from across a room in bad light with a candle in front of it. A fig is a difficult object. The fruit is dull-colored, lumpy, and nearly invisible against its own foliage, and the leaf is so distinctive that if you paint it correctly the viewer looks at the leaf instead of at the woman. A pomegranate is better but busy. A grape is a cluster, and a cluster in a hand reads as a harvest, not as a decision.

An apple is a sphere. It takes one stroke and a highlight. It is a color nothing else in the panel is. It sits in a palm at the exact size of a human gesture, and when a hand closes on it you can still see it, which is the whole requirement, because the point of the picture is that she is holding the thing she was told not to hold.

Every other candidate fails as an image. The apple is not the theologically correct fruit; it is the legible one. Your tradition did not reason its way to it. Your tradition drew it, repeatedly, because it was the easiest shape to draw that would carry the meaning, and after four hundred years of repetition the shape became the meaning, and then people went back and invented a pun to explain why.

I have watched a great many committees arrive at a decision in that order. It is the ordinary way. It just usually takes less than four centuries.

Dürer engraved it in 1504 with such authority that the matter was closed. He is careful, in that plate, in a way the people who copied it were not: the fruit in the woman's hand comes off one tree and the man is holding a branch of a different one, and the whole thing is a diagram of a doctrine. Nobody remembers the diagram. Everybody remembers the apple. Cranach then painted the scene something like fifty times over twenty-five years, for clients who wanted the same picture their neighbor had, with an apple every time, and that is not iconography. That is a workshop filling orders, which is how a standard is actually set.

And in 1667 an Englishman wrote the definitive version, and I regret to say he put the word in my mouth. Milton has his narrator say *fruit* throughout, carefully. It is my character who boasts, on returning to Hell, that he ruined mankind "with an apple." He has me say it with a sneer, as though I were amazed how cheaply you

sold. The blind man gave me the one line everybody can quote, and it is the one line in which I am wrong.

I notice, further, that the Latin word was not even Latin. There is something in this book that does accents and has gone into this at length: *mālum* and the Greek *mêlon* and the Albanian and the Hittite all appear to have been borrowed by Indo-European speakers from somebody else entirely, some vanished Mediterranean population that had the tree first and whose language is gone. So the word that is supposed to have condemned me was itself an immigrant with no papers. I find that fitting and I am not going to develop it, because the machine was thorough and I am lazy.

. . .

I will admit, privately, that if they had to pick something, they picked well.

Consider what was on offer in the garden. It was called the tree of the knowledge of good and evil. Now consider what the writer told you, some chapters back, about an apple seed. Every one a different creature. Most of them bitter, a few of them glorious, and no way on earth to know which until you have planted it, waited seven years and bitten. If you wanted a fruit to stand for knowledge of good and evil, you could not design a better one than a fruit whose every pip is an experiment in exactly that.

And consider what I am alleged to have promised. *Ye shall be as gods.* I notice your species did eventually get there, with this fruit specifically. You learned to take a tree you liked and make it immortal. You learned to say: this one, forever, and no other. The Almighty's method is the seed. He scatters ten thousand and lets them sort it out, and he is not sentimental about the nine thousand nine hundred and ninety-nine. Your method is the knife. I have always thought the graft was the real fall, or the real ascent, depending on who is telling it. You stopped accepting what was given. You began to keep what you preferred.

You even named the roots for the place you were thrown out of. For four centuries the best apples in Europe were grafted onto a dwarfing stock called Paradise. I could not have arranged a neater joke, and I want it on the record that I didn't.

And since we are on names. You could not settle the Latin one either. Linnaeus filed the apple under the pears. An Englishman

pulled it out and gave the genus the name on the cover of this book. Then a German attached a species name to the cultivated apple, and for two centuries afterward your botanists argued, in print, about whether the right name was the German's or an older one, with the stakes being nothing whatever except which label goes in the herbarium. It was finally settled in this century, by a vote, at a congress, in Shenzhen. Four thousand years of theology about this fruit, and the part you managed to resolve was the filing.

. . .

I had colleagues in the trade, of course. The Greeks understood that a round, shining, desirable thing is the natural shape of trouble.

At a wedding to which she had pointedly not been invited, the goddess Eris rolled a golden apple across the floor inscribed with one word, meaning *to the fairest*. Three goddesses claimed it. A shepherd was asked to judge. He chose the one who bribed him with another man's wife, and ten years and a wooden horse later a city was ash. One apple. I have studied that operation with real admiration. The economy of it.

Atalanta, the fastest runner alive, lost a footrace and her freedom because a suitor rolled three golden apples in her path and she stooped for them. Heracles was sent to the edge of the world for golden apples guarded by a serpent in a tree, which I assure you was a coincidence. In the north, the gods themselves stayed young only as long as a goddess named Idunn kept them supplied with apples, and when she was kidnapped they went gray inside a week.

I should mention, in the interest of the accuracy I am apparently now known for, that the Greek word in most of those stories is *melon*, and that *melon* had the same problem as *pom*. It meant apple, and it also meant any round tree fruit you cared to name. Scholars suspect several of those golden apples were quinces, and there are votes for the orange. The apple has a way of moving into any story that has a vacancy for a fruit. It is the most successful squatter in the history of metaphor.

The word *to the fairest* has, I am told, been claimed by another party in this volume, who has a mirror and a grievance of her own and who will tell you she is not aggrieved. Take that up with her. I have enough.

. . .

Now. The poison.

There is some, and I didn't put it there. An apple pip contains a compound called amygdalin. When the seed is crushed and wetted, amygdalin breaks down and releases hydrogen cyanide. It is the tree's way of discouraging anyone from chewing the one part of the fruit that matters to it. Swallow a seed whole and it will pass through you unopened, which is all it ever wanted. You would need to grind and eat a great many of them at a sitting to do yourself harm, on the order of a cupful, and no one has ever enjoyed a single one enough to continue.

But it is a pleasing fact that the old stories were onto something. The Grimms' queen prepares an apple that is white on one side and red on the other, and poisons only the red half. The girl sees the old woman bite the white side, concludes it is safe, and takes the rest. I point this out to the people who think temptation is a matter of offering something bad. It is a matter of offering something half good and eating the good half yourself, in front of them.

And then there is the one your century turned into a trademark legend, and here I would like to be exact.

On the eighth of June, 1954, the housekeeper of a mathematician named Alan Turing found him dead in his bed in Wilmslow, Cheshire. He was forty-one. He had done as much as any single person to win a war and had, more or less on the side, worked out what a computer is. Two years earlier he had been convicted of gross indecency, which was the law's phrase for loving a man, and given a choice between prison and a course of hormone injections that amounted to chemical castration. He took the injections. On the table by his bed was an apple with several bites out of it. The post-mortem found cyanide. The inquest called it suicide. It is known that he was fond of the film of *Snow White* and of the witch's scene in particular.

The apple was never tested.

You may make of that what you like. His mother believed it was an accident; he kept cyanide in the house for electroplating experiments, and at least one serious historian thinks she may have been right. What is not in doubt is that nothing in that orchard-bought fruit was the cause of what happened in that house. What killed

him, by one road or the other, was a statute. Your prime minister apologized in 2009 and your queen pardoned him in 2013, which I record without comment.

You have heard that the bitten apple on certain expensive machines is a tribute to him. It isn't. The designer has said so repeatedly: the bite was put there so that the silhouette would not be mistaken for a cherry. I mention it because it is a small specimen of the thing I have been describing all along. An apple, a death, a vacancy for meaning. You filled it. You always do. I have hardly had to work.

. . .

Which brings me to America, where I am told I have been busy.

They do see me everywhere there. In the cider barrel, for a start. For two hundred years every farmhouse in New England had a row of hogsheads in the cellar, and the same people who were sure I lived in the theater and the fiddle saw nothing of me in a breakfast tankard. Then, in about the space of one lifetime, I was discovered in the barrel after all, and decent men went out and cut down their own orchards to be rid of me. I had not moved. I'd like that understood. I was never in the barrel and I was never in the ax. I was, if anywhere, in the certainty.

But if you want to know which American apple I am proudest of, it isn't a cider apple, and it has nothing to do with drink. It is the red one. The tall one, with the five little knuckles on the bottom and a skin like a fire engine and a color so deep it is nearly black at the shoulders. It is the most beautiful apple ever grown, and for fifty years it was the most planted on the continent. It tastes of wet cardboard.

I did not make it. Understand how much more satisfying that is. Nobody set out to ruin that apple. It began as an honest seedling with real flavor. Then, for a century, every grower who found a branch a shade redder than its neighbors took cuttings from that branch, because the buyers paid for red, and each of those choices was perfectly reasonable, and at the end of all the reasonable choices there was a fruit that was nothing but its own advertisement. A later chapter has the particulars. I only want to say that it is my favorite kind of sin. No villain. No decision. Just a market, selecting.

You put a cage around the yellow one, by the way. A steel cage with a burglar alarm, around a tree on a hillside in West Virginia. In my day a cherub with a flaming sword was thought sufficient.

. . .

Since then you have gone on improving the fruit in ways I find instructive.

You have given it eternal youth. An apple wants to ripen; it breathes out a gas, ethylene, that tells itself and all its neighbors to soften and sweeten and get on with it. That is why one bad apple truly does spoil the barrel, a proverb your public officials now use to mean the reverse. You learned to stack the harvest in sealed rooms, pull the oxygen down to almost nothing and keep it just above freezing, so the fruit falls into a kind of sleep. Then, about twenty years ago, you found a compound that plugs the very receptors by which the apple hears its own ripening signal. A fruit so treated can sit for a year and come out crisp. The crisp apple you buy in June was picked the previous autumn. It is older than some marriages. Idunn would have paid anything for the formula.

You have given it a shine, with wax, to replace the natural bloom you scrubbed off.

And lately you have given it something I did not think to ask for. There is now an apple engineered so that its flesh does not brown when it is cut or bruised. The enzyme that causes the browning has been switched off. It can be sliced, bagged and left, and it will show nothing. A fruit that carries no visible record of what has been done to it. I tempt for a living, and I tell you I would have been ashamed to propose that one.

As to actual poison: from the 1890s until after the Second World War, your orchards were sprayed several times a season with arsenate of lead, which is what it sounds like, against the worm in the fruit. The British press had a scandal about arsenic on imported American apples in the 1920s. The stuff does not break down. There are tens of thousands of acres of old orchard ground in your Northwest, some of it under schools and housing now, where the lead and the arsenic are still sitting in the top foot of soil. In 1989 there was a national panic over a different chemical, a growth regulator sprayed on red apples to keep them on the tree and make them redder; an actress testified, mothers poured juice down the drain, the growers sued

a television network and lost. The scientists are still arguing about how much of that panic was earned. I didn't need to choose a side. I never do.

Notice the pattern. In none of this did anybody need me to poison the apple. You did it yourselves, each time, for the sake of a better finish.

. . .

So let me put my case plainly.

The genus is called *Malus*. I have carried that name on your behalf for a long time, and I have just spent several pages demonstrating that the name was borrowed from a dead language, that the pun it rests on was never made by anyone who could have made it, and that the actual culprits were a French vowel, a wedding song, a workshop in Wittenberg and a poet who could not see. I think it is time somebody looked at the ledger.

What was offered to you in the garden, by whoever was offering, was knowledge. In an apple, knowledge is the seed: the thing that might be anything, that is bitter nine times in ten, that you cannot own and cannot predict. You were told not to touch it. You touched it. So far, I approve.

But look what you did afterward. You found one fruit you liked, and you stopped. You took a knife and made that one tree into ten million, and you fenced them and sprayed them and patented them and put them to sleep in the dark for a year at a time, and you threw every seed in the trash. You have the tree of knowledge in every supermarket in the world, and you have arranged matters so that it never tells you anything new.

I offered you every apple. You chose a single one and photocopied it. I ask you, as a reasonable creature, which of us turned out to be the conservative?

Two more witnesses, since the management insists on fairness. One of them is the only person present who actually ate it. I have no notes for her. She was there, I was in the tree, and in four thousand years of litigation about that afternoon I notice that neither of us has ever been asked the one question she is going to raise.

But he is up next. He will tell you about vines. He always does. Ask him why, in three years of talking about fruit, he never once mentioned mine.

9

The Vine Has Some Notes

. . .

Narrated by Jesus

He is right that I never mentioned them. He is often right about facts. It is what he does with them afterward that you have to watch.

I grew up in the hill country of the Galilee and I taught with what was on the table. Figs. Olives. Wheat and the weeds that come up in it. Mustard, which is a nuisance in a field and which I am still rather pleased to have gotten a kingdom out of. Above all the vine. When the Law lists the good things of the land it names seven, wheat and barley, vines and figs and pomegranates, olive oil and date honey, and there is no apple among them, for a reason any orchardist could give you. An apple tree has to be cold before it can bloom. Its buds count the winter hours below a certain chill, hundreds of them, sometimes more than a thousand, and until the count is full they will not open. The lake country where I worked does not keep that kind of winter. You do not preach to fishermen about a fruit that grows three weeks' walk to the north.

There is a word in the older books, *tappuach*, that your translators made into apple. The beloved in the Song sits under one and finds the fruit sweet; she asks to be comforted with them. A proverb compares a word well spoken to apples of gold in a setting of silver. It may have been an apple. Learned people have argued for the apricot, the quince, the citron, mostly on the grounds that the climate of that country is unkind to apples, and nobody has settled it. Where the word itself comes from, and what it may once have meant, is gone into at length elsewhere in this book by something better equipped for the work than I am, and I will not take the bread out of its mouth.

I note only that the apple, here as everywhere, was given the benefit of the doubt.

And there is the apple of the eye, which is not in the Hebrew at all. What the Hebrew says is the *little man* of the eye: the tiny figure you see when you look closely into someone else's pupil, which is yourself, reflected. Keep me as the little man of your eye. It was the English who turned that into an apple, because they thought of the pupil as a small round solid thing. I don't mind. But I have always liked the original better. It says that to be held dear by someone is to be seen in them, small and whole.

So, no apples. Now let me tell you what I think about them anyway, since I have had a long time to consider the matter and since several things I did say turn out to bear on it.

. . .

I said: by their fruits you shall know them. Do men gather grapes of thorns, or figs of thistles? A good tree brings forth good fruit and a corrupt tree evil fruit.

For figs, that holds. For most of what a Galilean farmer grew, it holds; you plant the seed of a good thing and you get more of the good thing. I am told it does not hold for the apple, and I have been turning that over with real interest.

A good apple tree bears good fruit. That much stands. But take the seed out of that good fruit and plant it, and what comes up owes you nothing. It may be bitter. It may be small and hard. Once in a great while it may be better than its mother. The fruit tells you the truth about the tree and no truth whatever about the child.

I could have used that. There were people in my hearing who were very sure of themselves because of whose sons they were, and I had to tell them that God could raise up children to Abraham from the stones on the ground. An apple would have made the point more gently. Nobody inherits sweetness. Each one has to come up from the ground and be tasted on its own account.

It cuts the other way too, and this is the half people forget. You may not despise a seedling because of the tree it fell from, or because it came up in a ditch. I have been reading your orchard histories with the attention I used to give the lilies, and the thing that strikes me is where the great ones were found. In a fence row. In a brush pile on a new farm. By a creek where a woman had thrown out her kitchen

scraps. The one that became the most planted apple in your country came up where it was not wanted, between the rows of a Quaker farmer in Iowa, and he cut it down. It grew back and he cut it down again. The story goes that when it came up the third spring he let it be, and said that if it was so determined to live, it might.

I don't insist on the number. But you will understand why I noticed it.

The stone that the builders rejected has become the head of the corner. I was quoting a psalm when I said that, and I was talking about myself, and I did not expect to find it acted out in an orchard in Madison County. There it is all the same. The whole history of this fruit, as far as I can tell, is one long demonstration that the thing of value is usually growing somewhere it wasn't planted, and that the first instinct of a tidy farmer is to mow it.

. . .

Then there is the knife, which the other one made so much of.

I was raised by a builder. The word in the Greek is broader than carpenter; it means a man who makes things fit, in wood or stone. So when I first looked at how a graft is cut, I saw a joint. The long slant on the scion and the matching slant on the stock are what a joiner calls a scarf. The little tongue that some grafters cut into each face, so the two pieces lock, is a thing I have cut myself to lengthen a beam. A grafter is a carpenter working in living wood, and he has one advantage I never had. His joint heals. Mine only held.

Your Paul knew about grafting, though he was a tentmaker and it shows. Writing to the Romans, he says the Gentiles are a wild olive branch grafted into a cultivated tree, and he says in so many words that this is contrary to nature.

He is right that it is. No farmer does it that way. You graft the good variety onto the wild root, never the reverse; a wild branch on a noble tree would give you wild olives and a wasted tree, and you would have spoiled a producing tree to get them.

Some of your scholars have said he blundered, on the reasonable ground that a man from a city would not know. Others have gone to the Roman agricultural writers and found that something like it was done: that an old olive that had stopped bearing was sometimes grafted with wild wood to put vigor back into it, which is a real operation with a real purpose. If that is what he had in mind, then

he was not making a mistake. He was describing a thing you do to a tree that has stopped producing, which, given what he was arguing about his own people at that moment in the letter, would be a remarkably hard thing to say and would explain why he says it so carefully.

I am not going to settle it, because I was not consulted. I will say that the phrase *contrary to nature* is in the text, in his own hand, and that a man who did not know what he was doing would not have thought to put it there. He is describing something no sensible orchardist would do, in order to say that it had been done anyway, at the owner's expense, out of something other than good sense. On that reading he understood the whole business better than most people who have quoted him.

And I said, the night before I died, that I am the vine and you are the branches, and that my Father is the vinedresser, and that every branch that bears fruit he prunes, so that it may bear more. People find that verse hard. They would like to be left alone to grow. I can only report that I have never seen an unpruned tree or an unpruned life that was not mostly wood. I gather you are going to hear from an orchard on this point later in the book, at some length, and that it has opinions about a man who took the lesson very far.

. . .

One more thing about the graft, and I offer it carefully, because wars were fought over less.

Four hundred years after me, several hundred bishops met at a town called Chalcedon to settle how it could be that one person was fully God and fully man. They produced a formula. Two natures, it says, in one person: without confusion, without change, without division, without separation. Four words, all of them negative. They spent weeks on it. It did not hold. The churches of Egypt and Syria and Armenia would not sign, and they have not signed since, and the division is fifteen hundred years old this century and is still being worked at by men of good will who have inherited it from men who meant well.

A grafted apple tree is two natures in one tree. Above the union it is entirely the scion; a Pippin on a crab root bears Pippins, and no amount of sap from below will make them crabs. Below the union it

is entirely the root. They are not mixed. Neither turns into the other. And you cannot pull them apart without killing both.

Now the two honest qualifications, because a likeness that will not take correction is not worth having.

The first is that the root is not silent. It does not change what the fruit is, but it changes a great deal about it: how big the tree gets, how soon it bears, how large the apples run, how much water and mineral the top can draw, how early it goes dormant. Your orchardists speak of a root imparting vigor or withholding it. So the two natures are distinct and they are not indifferent to each other, and if you are going to use my tree as a figure you had better say that part too.

The second is the exception, and I would not have believed it if your gardeners had not made one and photographed it.

In a nursery outside Paris, two hundred years ago, a man grafted a purple broom onto a laburnum stock, and the graft did something that is not supposed to happen. At the union the tissues of the two plants grew into each other and produced shoots that were neither one nor the other, and the tree that resulted bears, on the same trunk, laburnum flowers and broom flowers and a third kind that is a muddle of both. It is not a hybrid; nothing crossed, no seed was involved. It is two plants grown together so intimately that one skin wraps the other's core, and your botanists call such a thing a chimera. There are perhaps a handful of them in the world.

They named it after the grafter, whose name was Adam.

I am aware of how that sounds. I have had a long time to get used to the way this material arranges itself. I only put it in because the bishops at Chalcedon spent three weeks ruling out confusion and change and division and separation, and because there is one tree in the world where the first of those four actually happens, and because it was made by accident by a gardener who was trying to sell something.

I do not say the likeness is exact. A theologian could find three heresies in it before lunch, and now a fourth. I say only that the bishops might have saved themselves some time by sending for a gardener.

. . .

He asked why I talk so much about vines. I'll answer him. It is because the vine was what my people had, and because of what it is for.

My first sign was at a wedding, and it was wine, and it was a good deal of wine, something over a hundred gallons by the measures John gives, for guests who had already been drinking. I have never been forgiven for this by a certain kind of person. They said of me in my own lifetime that I was a glutton and a winebibber. I let it stand.

When my followers came to keep the supper I left them, they kept it with bread of wheat and wine of grapes, and the church has held to that with a stubbornness I find touching. The law is still on the books: the wine must be the fruit of the vine, natural and unspoiled. Cider will not do. This caused real hardship as the faith moved north into countries where grapes sulk. The monks planted vineyards in the Rhineland and in England, at the very edge of where a grape will ripen, for the sake of the cup. And all around the vineyards, for the sake of everything else, they planted apples.

If you want to know who carried the apple through the dark centuries of Europe, look to the abbeys, and let me be particular about why it was them and not somebody else.

A monastery is a household that expects to be in the same place in three hundred years. That is the whole of it. Fruit growing is not difficult work but it is long work, and it punishes an owner who may have to move. The Rule those houses lived by put manual labor into the daily order alongside prayer and reading, so there were hands; the houses held land in perpetuity, so there was ground; and they kept written records, so there was memory, which is the part everybody forgets. A variety is a name attached to a tree by somebody who intends to still know the name in forty years.

The evidence is dull and it is good. A Frankish administrative order, drawn up for the royal estates around the end of the eighth century, instructs the stewards on what to plant, and lists apples by name, several of them, sweet and sour and keeping kinds. Those are the oldest named apple varieties in the West and they survive because a government was doing inventory. A plan drawn for a great abbey a few decades later lays out an orchard, with the trees named on the drawing, and puts the monks' graveyard in it, so that

the brothers were buried among the fruit trees and the trees were tended by the men who would lie under them. A monk at that same house wrote a poem about his own garden, which is the first thing in Europe for a very long while that is simply a person being pleased with plants. Four hundred years later a Dominican friar wrote a long and careful treatise on plants that discusses grafting as a matter of ordinary practice.

And when a house founded a daughter house, a few days' journey off or across the sea, the monks who set out carried books, relics, vine cuttings and a bundle of apple scions wrapped in damp moss. A stick cut from a tree in Burgundy went into a root in Yorkshire, and a stick from that tree went on to Denmark.

I have heard it said that a bishop today can trace the hands laid on him back, one ordination at a time, to the men I chose myself. I can't vouch for every link. But I know a thing of which it is strictly true. Every tree of an old apple variety was cut from a tree that was cut from a tree, without a single break, back to the first one. Hand to hand. If the chain had failed once, in any century, the variety would be gone. Your writer said some chapters ago that such a tree is one old plant on life support. I would call it a succession. It is the nearest thing in nature to what I asked my friends to do, which was to pass on exactly what they had received and to do it in person.

The vine has needed mercy since. In your nineteenth century a root louse from America reached France and the vineyards of Europe began to die, the oldest and proudest first. They were saved by grafting every one of them onto the roots of wild American vines, rough things nobody would have let near a wine press. The noblest wine in the world has lived for a hundred and fifty years on the roots of a stranger. I did not arrange that. I recognize it.

. . .

I should say something about what your country did with the cup and the barrel, since he brought it up.

There was a Methodist dentist in New Jersey named Welch who was troubled that the Lord's Supper required something that made men drunk. In 1869 he worked out how to heat grape juice in the bottle so that it would never ferment, and he sold it to churches as unfermented sacramental wine. It did not sell at first. It was his son, a generation later, who made a business of it, and the business was

not really a sacramental one; what he sold, in the end, was grape juice to everybody, at a world's fair and after it, and the communion cup was the doorway.

The grape in those bottles is worth a word, because it is one of the few things in this book that actually is American and because of how it was got.

A man in Concord, Massachusetts, planted seeds from a wild native vine growing on a hillside, and raised several thousand seedlings, and tasted his way through them, and kept one. He put it out in 1854. It was hardy where the European vines died, it ripened in a short northern season, and within a few years it was the grape of the whole eastern half of your country, and it still is; the juice in the communion cups and the jelly in your children's sandwiches are both that one vine, cut and recut.

He made almost nothing from it. Once the first cuttings were sold there was nothing to stop anyone propagating it, and everyone did, and the nurseries and the juice men and the jelly men got the money and he kept his garden. He died poor in the house the vine was found behind. The words on his stone say that he sowed and others reaped.

I notice that this is a seedling story. One man, several thousand gambles, one winner, no patent, and a fortune made by the people who copied it. I also notice that it is a better account of my own position than most of what has been written on the subject, and that he did not, as far as the record shows, complain.

In those same years, as you have read, sincere men were cutting down their apple trees so as not to have cider in the house. I understand what they were afraid of. I have seen what drink does to a household. I buried people it killed. But I notice that I was never once asked whether the fault was in the fruit. It is not what goes into a man that defiles him. I said that about food, and I meant it more widely. Nobody has yet been made sober by an ax.

. . .

On the other side of the ledger, I am fond of what the Germans did.

In the old western calendars the twenty-fourth of December was the feast of Adam and Eve. They were saints in those books, which surprises people, and their day fell on the eve of mine on purpose, so that the Fall and the remedy stood next to each other in the year. In

the Rhineland the townspeople marked it with a play of the garden, performed in the street, and a play of the garden needs a tree.

It was winter and the trees were bare, so they stood up a fir, the one green thing to hand, and hung it with apples for the forbidden fruit. Then, because the play did not end at the Fall, they hung it also with small round wafers of the kind used at the altar. Fruit on one branch and bread on the next. The tree of the Fall and the table of the remedy on the same fir, in the street, for people who could not read.

In time the tree came indoors and the play was forgotten. That is your Christmas tree. The apples became balls of glass; there are two or three villages in the glassmaking country, on both sides of that border, that will each tell you their blowers made the first ones in a year when the apple crop failed, and I am not going to adjudicate between them. The wafers became the little iced biscuits that are still hung on trees in those countries, and which nobody now thinks of as anything but a biscuit.

So on the eve of my birth you set up the tree of the Fall, and you hang it with fruit, and you put a light on top. No council told anyone to do that. It is better theology than much that councils did. The first Adam and the second, in one room.

Some English poet whose name is lost went further and wrote a carol in which I am the apple tree myself. I have been called a lamb and a door and a vine and a rock. I was pleased to be a fruit tree at last. And in the countries of the East, on the feast of my Transfiguration in August, the people bring the first apples of the year to church to be blessed, and by old custom no one eats an apple before that day. I never asked for it. I accept.

As for the barefoot man in Ohio who told the settlers he had news fresh from heaven: I do not recall sending him, though I have employed stranger. He gave trees on credit to people who could not pay and did not press them for it. He slept on floors. He walked ahead of everyone else to plant what he would not be there to harvest. I know that bookkeeping. I will say nothing about his theology except that he seems to have gotten the conduct right, which is the harder part, and which I rather emphasized.

One correction for the record, since we are correcting things. My servant Augustine, who wrote more about sin than any man should, built his whole account of it on a night in his youth when he and

some friends robbed an orchard. They were not hungry. They took the fruit for the joy of taking it and threw most of it to the pigs. He never got over it. The fruit was pears. In sixteen centuries of sermons on that passage I do not believe one preacher in ten has remembered. Nobody gets the fruit right.

. . .

He ended with a question, and it was a good one. He said that you were offered every apple and chose a single one, and he asked which of you turned out to be the conservative.

I would rather ask a different question, but first I'll grant him his arithmetic. He has the mathematics of the orchard right. A breeder plants ten thousand seedlings, keeps one and burns the rest, and has to, or there would be nothing worth eating. A grower cuts off nine fruitlets in ten so that the tenth will be large. The vinedresser prunes. I said so myself.

But I told a story once about a shepherd with a hundred sheep who loses one, and leaves the ninety-nine on the hillside to go after it. Every farmer who heard me knew it was bad husbandry. That was the point of it. The arithmetic of the orchard is true, and it is not the only arithmetic.

So here is my question. What do you owe the nine thousand nine hundred and ninety-nine?

In the Law there is a rule for harvest. When you reap your field you shall not reap to the very corners. When you beat your olive trees you shall not go over the boughs a second time. When you gather your grapes you shall not pick the vineyard bare. What is left belongs to the stranger, the fatherless and the widow. It is a commandment to be a little inefficient, on purpose, for the sake of whoever comes along after you with nothing.

I think an orchard can keep that law. Leave a corner where the seeds are allowed to come up. Let a wild one stand in the hedgerow. It will mostly bear spitters, and the deer and the wasps will be glad of them, and once in a long while something will come up there that no one planned and no one owns. You have built a great storehouse of the trees you already know. I would only ask that you leave the door open for one you don't.

I said that unless a grain of wheat falls into the ground and dies, it remains alone, but if it dies it bears much fruit. That is true of every

seed. For this one I am told it helps if it first passes through a bear, and I can't improve on that.

Later in this story there is a tree that was given every advantage and lost its savor. I said something about salt along those lines. You will see what I mean.

10

Eve

. . .

Narrated by Eve

Nobody has ever asked me what it tasted like.

Think about that for a moment, because I have had a long time to. There are libraries about that afternoon. There are councils, canons, catechisms, nine hundred years of paintings, a twelve-book poem in blank verse, and a Rutgers philologist who went through the whole Latin West line by line to find out when the fruit became an apple. Men have been excommunicated over my afternoon. Women have been buried under it.

And in all of it, in the entire record, not one person has written down the one piece of information that only I have.

I am the single eyewitness in this book. Everyone else in this book is a commentator. The one with the pitch was in the tree and did not eat. The carpenter's son came along four thousand years later and has the grace to say so. The queen in the mirror handled an apple professionally and never once put one in her mouth. The orchard cannot taste its own fruit. The circuit board has no tongue. The worm, poor thing, had no mouth at all.

I bit it. I am the only one who did.

So I want you to notice what you have done with the only primary source you had. You have used me for four millennia as evidence of a doctrine, and not once as a witness to a meal.

. . .

Let me say what is actually in the text, since so few of the people who argue about it have read it lately.

The word is *peri*. It means fruit. That is the whole of the botanical description. The author who gave you the dimensions of a boat in cubits, and the name of every river running out of that garden, and the mineral deposits in the countries those rivers watered, declined to say what tree I was standing under.

I am not going to do the etymology. The one with the pitch has already done it, two chapters back, at length, with footnotes, and he wants the credit corrected. That is his business and he is welcome to it. I have a different complaint, and it is not about credit. It is about the charge.

Because here is what the record says, and it is short.

A command is given. *Of every tree of the garden thou mayest freely eat: but of the tree of the knowledge of good and evil, thou shalt not eat of it.*

It is given to the man. Chapter two, verse sixteen.

I am made in verse twenty-two.

Read those two verses in order sometime and sit with the gap between them. The only rule in the world was issued before I existed, to somebody else, and by the time I was awake it was already tradition. I did not hear it from the one who made it. I heard it from the one who heard it. I was the first person in the history of the world to be told something secondhand, and every single one of you has been in my position ever since, about nearly everything you believe.

When the serpent came and asked me what the rule was, I gave it back with a line added. We may not eat of it, I said, *neither shall ye touch it.* The commentators have had a wonderful time with that. Some of them say I was embroidering, which is a thing women do. Some of them say the man added it when he passed it on, to be safe, and so the first man-made fence around the law in history was built by the man.

I will not adjudicate. I will only point out that a rule which arrives through one other person always arrives with something on it, and that this is not a flaw in me. It is what a rule is, once it has been carried.

. . .

Now the part everyone skips.

And when the woman saw that the tree was good for food, and that it was pleasant to the eyes, and a tree to be desired to make one wise, she took of the fruit thereof, and did eat, and gave also unto her husband with her; and he did eat.

With her.

The Hebrew is *immah*. He was standing there. He was present for the conversation, the whole of it, the entire argument with the serpent, and he did not say one word. Not a word of warning, not a question, not the rule he had been given personally by the voice that made the sky. He waited until the transaction was complete and then put out his hand.

I am not making an accusation. I am reading you a word. It has been in every manuscript for three thousand years, printed in every Bible on every nightstand in your country, and most of your preachers have gone their whole careers without seeing it, in the same way that millions of people a year stand under a famous ceiling in Rome and look straight at a fig and see an apple.

You see what you came in holding.

But look again at the verse, because it contains something I want returned to me, and it is not an excuse. It is a list.

Good for food. Pleasant to the eyes. To be desired to make one wise.

Three criteria. Nourishment, appearance, knowledge. That is the oldest grading standard in the literature of the world and I am the one who wrote it, standing in front of the merchandise, doing what anybody does.

Your Department of Agriculture grades on the second one. It has a whole document: percentages of surface in the required shade, and a top grade whose name is an adjective about looks. The first criterion gets a sugar reading at the packing house. For the third there is no column, no form, no inspector and no grade, because knowledge cannot be assessed through a crate at a loading dock by a man with a clipboard, and because by the time a thing has made you wiser you have already eaten it and nobody can take it back off you.

I have read ahead, and the queen in the glass is pleased with all this and considers you her heirs. She would. She is in the business

of the second criterion, and she has never had the slightest interest in the third.

I had all three on the list. I have been punished for exactly one of them, and your entire four-thousand-year tradition has agreed about which: the pretty one. That is the vanity reading, the one with the mirror in it, and it is the reading that makes me a woman in a story about a woman.

The verse says all three. The third one is longest.

. . .

I should tell you about the names, since this is a book about what things get called.

The man named the animals. Chapter two: every beast of the field and every fowl of the air brought to him to see what he would call them, and whatever he called them, that was the name thereof. A whole taxonomy in an afternoon. You still use the arrangement.

He named me twice. First *ishah*, woman, taken out of man, which is a description rather than a name and is how a great many of us have been addressed since. Then, after everything, after the sentence was read out and the ground was cursed and we were walking out, he named me Chavvah. Your translators made it Eve. The Greeks, translating in Alexandria, didn't even transliterate it; they just put down the meaning, Zoe, Life.

I was named for life on the afternoon I was told I would die. By a man. Who had just finished explaining to the voice in the garden that the woman gave it to him.

I want to be accurate about my own grievance, because this book is full of narrators enjoying theirs. It is a good name. He was not being cruel; he was being something closer to desperate, and it is the only generous thing anybody says in the whole chapter. I note the arrangement and nothing more: in a book where naming is authority, I was assigned two names and given the chance to confer none.

Except once.

Chapter four, verse one. I bore a son, and I named him, and the text gives my reason in my own mouth, which it does not do for the animals. *Qaniti ish et-YHWH.* I have gotten a man with the Lord. It is the first naming speech by a woman in your canon, and I notice

what I did with my one turn. The man had named kinds. I named a person.

He grew up and killed his brother.

Nobody has ever hung that one on me. Four thousand years of sermons about how I am the reason for death, and not one of them lays the first actual death at my door, because that would require thinking about me as a mother rather than as a mouth, and the doctrine does not have a shape for it.

. . .

The rabbis guessed, and I have affection for them, because they at least guessed about the food.

Four candidates. The fig, the grape, wheat, the citron. They argued it in the Talmud and in the midrash and they never once said apple, which ought to tell you something about how recent your certainty is.

The fig was the popular answer, and I like the reasoning best of the four because it is detective work. A verse and a half after the eating, the two of us are sewing fig leaves. A person in a sudden hurry grabs what is nearest. Therefore, the fig. They reasoned backward from the only physical evidence in the room, which is more than Dürer did.

The grape, because nothing brings wailing into the world like wine. Fair.

The citron, because of a puzzle in the first chapter about a tree whose wood tastes like its fruit, and the citron is the only one. That is a beautiful piece of reading and it is about something else entirely, and I love it anyway.

And wheat. A rabbi said wheat, on the grounds that a child does not know how to say father and mother until it has tasted grain.

That one is the true answer and it is not even in the running in your tradition, because it is not a fruit and because it ruins the picture. Knowledge, says that man, is a thing a child grows into by being fed, over years, by somebody who keeps feeding it. Not swallowed. Not stolen off a branch in an afternoon. Nobody has ever painted it. You cannot hang a stalk of wheat in a woman's hand on a cathedral wall and have anyone understand what is being alleged.

I have lived longer than that rabbi and I think he was closer to what happened to me than anyone before or since.

. . .

Then there is the industry.

A man in Jerusalem, two centuries before the carpenter, wrote in his book of wisdom that from a woman was the beginning of sin, and because of her we all die. One sentence. It has outlived its author by two thousand two hundred years and it is still being quoted at women in rooms they cannot leave.

A letter in your New Testament says that the man was not deceived, but the woman being deceived was in the transgression, and uses it as the grounds on which a woman is not to teach.

A lawyer in Carthage wrote an essay to the women of his congregation about their clothes, and told them that each of them was Eve, and called them the devil's gateway.

I am not going to answer any of it, and that is a policy, not a shrug. Answering is how you agree to the terms. Argue that I was not the beginning of sin and you have conceded that the question on the floor is my character. It is not. It is a fruit, and a rule I got secondhand, and a husband standing silently at my elbow, and three reasons on a list, one of which was knowledge.

I will make an exception for the blind Englishman, because he is the only one who did me the courtesy of a voice.

He gave me more lines than Genesis did. Hundreds. He gave me a dream, and a garden I worked in, and an argument about whether we should divide the labor, and a long speech after the fall in which I propose that we have no children at all so that there will be nothing for death to feed on. It is the best writing anybody has done about me and some of it is almost right.

The one with the pitch complains that this poet put a word in his mouth. He got off lightly. The poet put a *personality* in mine, and your professors have been quoting it back at me as my own testimony ever since, and when they want my view on something they do not open Genesis, where I have nine sentences. They open a poem written in London by a man who had gone blind, and they read my motives out of it, and they write the citation as if it were an interview.

That is the only thing in the whole four thousand years that genuinely wounds me. Not the sermons. The ghostwriting.

. . .

Now the seeds, because that is why I was asked here, and because it is the one part of this that I can tell you with authority.

Your author has been saying it for ten chapters and keeps not quite saying it plainly, so I will. The knowledge of good and evil is a seed.

Cut the fruit across its middle and you will find the star, and in each chamber a seed or two, brown, smooth, built to slip through an animal unopened, with a little cyanide in it to discourage chewing, because it is the one part of that fruit that was never addressed to you.

Every one of them is a different creature. Not a variation on the parent: a different creature, a thing that has never existed, that will never exist twice. Nine in ten are bitter. Some are small and hard and worth nothing. Once in a very long while one is better than anything anyone has grown.

And there is no way on earth to find out which is which except to put it in the ground, wait eight years, and bite it.

That is not a resemblance. That is the thing itself. If you had set out to design an object that was knowledge of good and evil, not a symbol of it, the actual commodity, you could not improve on a seed that is mostly bitter, entirely unpredictable, impossible to assess in advance, and that reveals what it is only by being eaten by somebody who cannot take it back.

So consider what I was standing in front of, and what the prohibition actually was.

It was not a prohibition on a flavor. You cannot forbid somebody a flavor; you can only not give it to them. It was a prohibition on finding out. And the particular cruelty and the particular honesty of it is that *finding out* was the only available verb. There was no other way to get it. I could not have been told. Being told is how I got the rule, and you have seen what happens to a thing that is told: it arrives with a fence around it that somebody else built.

I could only be the one who found out.

Every grower, every breeder, every farmer in the rest of this book is in the identical position and not one of them has been cast out for it. A breeder in Minnesota plants ten thousand seedlings and walks the rows for years with a knife in his pocket, tasting, and he cannot know, he genuinely cannot know, until he bites it. That is my

sin. That is the whole of my sin, performed under fluorescent lights with a grant, and you give him royalties.

. . .

There is one more thing I am owed a word on, and then I will go.

They call me the mother of all living. It is a title in the text and it is the reason for the name, and your tradition has mostly treated it as a decoration on a woman who is really there to have done something wrong.

I would like it taken literally for one paragraph.

Everybody who has ever lived is a seed that came up. Not a copy. Not a cutting bound to a root with tape, not a scion carrying its parent's fruit unchanged for four hundred years, not one old plant on life support. A fresh deal from a shuffled deck, every time, unpredictable, unassessable in advance, mostly not what anyone was hoping for, and impossible to evaluate until it has grown and been met.

The carpenter's son asked a question in the chapter before this one. He granted the arithmetic of the orchard: ten thousand seedlings, keep one, burn the rest. And then he asked what you owe the nine thousand nine hundred and ninety-nine.

He asked it well and he asked it as a man who had no children.

I will answer it as the one who did. You owe them everything, and the reason is not mercy. It is that the arithmetic is wrong. An orchard can burn the rejects because an orchard already knows what it wants and is only looking for more of it. That is not breeding; that is shopping. The nine thousand nine hundred and ninety-nine are only waste if the thing you were after was the one you already had.

I had two sons and one of them killed the other, and I had a third, and the line that came down to you ran through the third. Not the first, whom I named with my own mouth and my own etymology and considerable pride. The third. The one nobody had a speech about.

You cannot know. That is the condition. That is what was on the tree.

. . .

So: what did it taste like.

I notice you want that, now that I have mentioned it. Four thousand years without a single question and you have got there in twenty minutes, which is about how long it took me.

I am not going to tell you, and I want to be exact about why, because it is not coyness and it is not a punishment. It is that there is no sentence that would do it. If I could hand you the taste in words, then it could be given rather than taken, and the whole garden was an argument that it cannot be. You would have the knowledge of good and evil off a page, secondhand, with a fence around it, from someone who was there, and you would believe you had it, and you would not have it, and that is a worse condition than mine.

I will tell you the only honest thing, which is the thing every orchardist in your country already knows and does not think of as theology.

It was not what I expected. That was the entire content of it.

Go and get your own.

Cut one across the middle, where the star is, and take out the brown teardrops, and put them in the cold through the winter, and in the spring put them in the ground. In eight or ten years you will have a tree that has never existed, bearing a fruit that no one has graded, that has no name and no sticker and no club, and that nobody on this earth, including you, including me, including the voice in the garden, can tell you one single thing about until you bite it.

That is the forbidden one. It always was. It is sold in bags of five pounds, and the part that mattered goes in the bin.

I ate it knowing nothing and I would do it again knowing everything, and I notice that my husband, who was standing right there the whole time, is the one your language calls innocent.

11

A Barrel of Hard Cider, 1840

. . .

Narrated by a cider barrel in a Massachusetts cellar

I am a measure.

That is the first thing to understand about me and most people never get past the second, which is that I am a container. Any box is a container. What I am is an agreed quantity. Thirty-one and a half gallons, white oak, riven not sawn, thirty staves and a pair of heads, six hoops, one bung, one spile hole stopped with a whittled peg. My brothers in the cellar are hogsheads and hold sixty-three, which is two of me, and the whole arrangement runs on the fact that everybody in the township knows that without having to be told.

When a man says he put up forty barrels this fall, he is not describing his woodwork. He is giving you a number, and the number is me.

So I keep the accounts. It is the only thing I have ever been good at and I have been doing it in this cellar since the autumn of 1809, which is longer than anybody who ever drew from me, and considerably longer than the Republic has been able to agree about what I am for.

. . .

Here is the year, as I had it for about thirty of them.

October. The apples come in from the seedling trees above the barn, and nobody can tell you the name of a single one because they haven't got names. They came up where the pips went. The family calls the big one by the wall the Sheep-Nose and the one by the lane the Bitter Tree and that is the whole of the nomenclature. They are not for eating. Two or three of them are for eating and the rest

would strip the enamel off your teeth, and that is exactly what the man wants, because sour and bitter are not faults in my line of work. Tannin and acid are the frame of the thing. Sweet dessert fruit alone makes a cider like dishwater and anyone in the trade could have told you so.

They go under the stone wheel, horse-drawn, round and round. The pomace is built up in layers between straw into a thing they call the cheese, and the screw comes down on it, and the juice runs into a tub, brown and cloudy and smelling of the whole autumn at once.

Then I get it. Forty gallons in, because it works over the bung for a week and throws off a third of what you give it in foam, and then it settles and I have my thirty-one and a half, and it gets quietly, patiently alcoholic in the dark at the temperature of a Massachusetts cellar, which is the correct temperature and always has been.

By December I am drinkable. By March I am good. By June I am sharp and by August I am vinegar, and the household plans around all four of those facts, and the mother of the house will tell you that she needs me to go to vinegar on schedule, because vinegar is how the beans and the cucumbers get through to next spring.

What was drawn out of me, per day, by a family of seven, including the children and the hired man:

Breakfast, a tankard each. Midmorning in the field, a jug carried out. Dinner. Midafternoon. Supper. Anybody who called at the door. The minister, twice.

I was empty by the third week of January and I was the fourth barrel down the row.

Nobody thought this was remarkable and nobody thought it was drinking. You want to understand that or you will not understand anything that happens later in this chapter. The well is forty feet from the barnyard and downhill of it. What comes out of that well in a wet August has killed children in this township and everyone knows it and nobody knows why. I am mildly alcoholic and I am acidic, and whatever is in that well does not live in me. I am not an indulgence. I am the safe liquid.

There was a man in the trade counting all this up a hundred and seventy years later, and he worked out that around 1830 the country was putting away something close to seven gallons of pure alcohol per adult per year, which is roughly three times what it drinks now.

He also worked out that cider ran at something like fifteen or eighteen gallons a head, and then fell off a cliff.

I am going to tell you about the cliff. It takes the whole of the nineteenth century and nobody pushes it.

. . .

But first, the ax, because that is the part everybody has heard and almost nobody has heard right.

In 1826 some ministers in Boston founded a society against ardent spirits, and I want you to notice that phrase, because I am not an ardent spirit. Ardent spirits are distilled. Rum, whiskey, gin. For the first ten years of the temperance movement I was on the *right side*. I was the moderate alternative. Reformers recommended me. A man signed a pledge against the jug and then came down to this cellar and drew off a tankard of me with a clear conscience and the full approval of his minister.

Then in 1836 the Temperance Union took the other pledge, the total one, and I was in it.

What happened next happened in this cellar, so I can be exact.

There was no agent. There was no warrant, no raid, no bureau, no man from any capital. There was a farmer, who had been to a meeting, and who came down these stairs on a weekday morning in his own boots with his own ax, and stood looking at us for a while. Then he went back up and out to the trees.

He was sixty-one. He had planted them. It took him two days.

I want that in the record with the right weight on it, because when your century tells this story it always puts a uniform in the doorway, and the reason is that a uniform is easier to be angry at. Nobody came for us. A man did sums about his own soul and came to a conclusion, and the conclusion had an ax in it, and he was not a fool or a fanatic. He had watched what the jug did to his brother, and he could not see any line between the jug and me that would hold up in front of God.

I think he was wrong. I would, wouldn't I. But he was not *sent*, and the difference between a man who decides and a man who is sent is the whole difference between a conscience and a myth, and your country has spent a hundred years preferring the myth.

The historian who went through the Ohio records found the same thing from the other direction: the stories of converted farmers cutting down their own seedling orchards are real and they are in the papers of the time, and he argues they were not what killed the orchard. The railroad was. People would rather hear about the ax.

. . .

Now, 1840, which is the one year in my working life when I left this cellar.

The Whigs had a general. Sixty-seven years old, a victory at Tippecanoe three decades back and not much since, and a party that had decided the safest candidate was the one with the fewest opinions. A Democratic paper in Baltimore printed a sneer about him. Give him a barrel of hard cider and a pension, it said, and he will sit the rest of his days in a log cabin.

They meant it the way a man in a city means it. They meant: *rustic*. They meant: *finished*.

The Whigs read it over breakfast and could not believe their luck.

By spring I was being rolled. Out of this cellar, up the stone ramp, into a wagon with my hoops polished, and into the square of a town I had never seen, under a banner, next to a log cabin built on a cart with a live coon on the roof and a latchstring out and smoke coming from the chimney. There were songs. There were thousands of people. There were miniature log cabins and log-cabin handkerchiefs and log-cabin shaving soap, and a cane with a cider barrel carved on the handle, and a gentleman from Philadelphia bottling whiskey in a glass bottle shaped like a log cabin with his own name blown into it, which was Booz.

I will spare you the obvious and tell you it is not true. Your word for drink is four hundred years older than that gentleman and comes out of Middle English and Dutch. He simply had the best surname in the history of commerce and knew it.

They tapped me in the square and the crowd drank me in about nine minutes, which is the fastest I have ever been emptied and the only time it was done by strangers.

Now, the general.

He was born on a tidewater plantation in Virginia. His father signed the Declaration of Independence. He was educated for medicine, he married the daughter of a judge who owned a great

deal of Indiana, and his house at North Bend was a sixteen-room frame affair that had, somewhere inside it, like a pit in a plum, the original cabin it had grown around. He had never in his life been poor and had never once claimed to be.

The record has him on a platform in Columbus that summer, and what the record has him say is that it is true a part of his dwelling house is a log cabin, and then, on the subject of hard cider, a pause.

I was not in Columbus. But I have thought about that pause for a hundred and eighty-six years and I will tell you what I think is in it. I think it is a wealthy and reasonably honest man discovering, in public, in front of twenty thousand people, that he has been assigned a prop and that the prop is me, and doing the arithmetic on how much of his dignity it is worth.

He won. Eighty percent of the eligible men in the United States came out and voted, which had never happened before and has not happened often since. The log cabin and the cider barrel did that. The first modern campaign in your country's history was run on a drink the campaign's own supporters were busy chopping down the trees for.

Then he stood in the cold without a coat and gave the longest inaugural address ever delivered, and he was dead in thirty-one days, and your schoolbooks say the speech killed him.

Two physicians went back through the record in 2014 and made a different case. There was no sewer system. The night soil of the city of Washington was dumped on open ground a few hundred yards upstream of the spring that supplied the President's house. They think it was enteric fever.

So: the man who was elected on a barrel of hard cider was, in all probability, killed by the water.

I would like to say I find that funny. I find it like a stone in the boot. That was the *job*. That was what I was for in every farmhouse from Maine to the Ohio, for two hundred years, and he was the one household in the Republic that could not get a clean drink out of me, and he had run on my picture.

. . .

Here is how I actually died, since you have been promised an ending with no villain in it.

Germans. Hundreds of thousands of them, and then millions, and they brought a yeast that works cold and slow at the bottom of the vessel instead of warm and fast at the top. Lager. There is a story that a man carried the yeast into Philadelphia in 1840, the same year as my parade, and I am obliged to tell you that the brewing historians who went looking for that man have had some difficulty finding him.

The yeast is real whatever the story is, and the point about it is not taste. The point is the calendar.

I happen once a year. I am tied to a tree, and the tree is tied to October, and if the crop fails there is no cider and no argument. Beer is made from grain. Grain is a dry good. It ships, it stores, it waits in a sack. A brewery in a city can run in March and in July and in any year it likes, at a scale I cannot imagine, and sell to men who have no cellar, no trees, no press and no horse, because they live in three rooms over a shop.

That is the whole of it. Americans moved to town. A barrel is a rural object. It requires an orchard, a mill, a cellar, a man who knows when to rack it and a family large enough to drink thirty-one and a half gallons before it turns. Take any one of those away and I am a nuisance.

And the orchard above the barn went too, for the most ordinary reason of all. The railroad came through in the forties and a man in Boston would pay cash money for a barrel of sound red Baldwins packed in straw. Nobody would pay anything for the Bitter Tree. So the seedlings came out and the grafted eating varieties went in, in rows, on the nurseryman's advice, and within two generations there was nobody left who could tell you what the Harrison tasted like or that there was a reason to care.

I went to vinegar in 1851 and stayed vinegar for eleven years, which is the longest steady employment I ever had, and then the mother of the house died and her daughter kept the pickles in glass.

. . .

There is a draft in the northeast corner of this cellar and in 1920 somebody stuffed it with newspaper, so I have had a certain amount of reading matter, though it is foxed now and the mice have had the middle of it.

That is how I know about the Act, and I want to go through it, because your author has already said this in his fourth chapter and a thing said is not a thing shown.

The Act did not ban me. The Act has a section near the end of the second title that says in plain statutory English that the penalties for manufacturing liquor without a permit do not apply to a person making nonintoxicating cider and fruit juices exclusively for use in his home.

Read that twice. *In his home.* The thing they had just spent a decade and a constitutional amendment outlawing was specifically, deliberately, in writing, permitted in the one place I have ever lived.

The two hundred gallons everybody quotes, and your author has admitted to quoting it, is not in that sentence. The statute gives no number. The number comes out of the regulations the Treasury wrote afterward to say what the section meant in practice, and it is the regulation, not the law, that handed every household in the United States a legal allowance of six of me a year.

Call it six of me. That is the honest unit. A family could make, lawfully, under federal Prohibition, six barrels of what was in me, and the word *nonintoxicating* did the work that words of that kind always do, which is none, because nobody was going to come down a farmer's cellar stairs with a hydrometer.

And nobody did. That is the part that matters and it is an absence, which is a hard thing to put in a pageant.

Orchard historians have gone looking. A cider researcher in Colorado went looking. The man who did the Ohio land records went looking. They wanted one enforcement file. One court docket. One county newspaper paragraph. One photograph of a revenue man standing in a row of trees with an ax, which is the easiest photograph in the world to take and the kind of thing the press of that era photographed constantly.

Nothing.

What they did find is that the bureau charged with enforcing the thing sat in the Treasury Department until 1930 and then moved to

Justice, and that the outfit everyone names in the story, the one with the initials, did not have those initials until 1935, two years after it was all over.

So the men with the axes in the orchards were:

A sixty-one-year-old farmer in 1836, with his own trees, on his own time, for reasons he would have called salvation.

And nobody else.

. . .

I am still here. Empty since the Johnson administration, the first one, hooped, dry, standing on my head in the northeast corner with a crate of jars on me. The house above me burned in 1894 and the cellar hole is what they call it now. There is a lilac that marks where the door was, and three of the grafted Baldwins are alive in a ring of sumac and have not been pruned since the Wilson administration, and they still bear, and the deer have them.

A man from Massachusetts, dying, wrote an essay about wild apples in the last year of his life, and part of it is a lament for exactly this cellar: orchards cut down, cider going out of the country, and the fruit that is left coming grafted and tame from a nursery. He was watching it happen in real time and he knew what was going.

Here are my accounts, closed.

Gallons held, lifetime: something over thirteen hundred, if you count the vinegar years, and I do.

Times filled: forty-three.

Parades: one.

Federal agents seen: none.

Axes seen: one, carried down these stairs by the man who had planted the trees, who put it back on its hook afterward and sat on the bottom step for a while before he went up.

Varieties lost out of the orchard above this house, with no name, no record, no scion wood taken and no possibility of recovery: eleven.

That is the number I would like somebody to write down. The country has an argument about who killed the cider and it is the wrong argument, because nothing killed the cider; the cider was a thing people stopped having a use for, the way they stopped having a use for me, slowly, reasonably, one sensible decision at a time, over eighty years, with nobody to blame and nobody to sue.

What was *killed*, in the sense of being there on Monday and not on Wednesday, was eleven individual trees on a hillside in Worcester County that had never existed before and have not existed since, each of them a separate experiment that this continent was running for free, and the man who cut them down thought he was giving up a drink.

I am a measure. I measured what came out of them for forty-three autumns and it is the only record that was ever kept, and I am the only one left who can read it, and I am a barrel.

Somebody is making cider again, I am told. Up the valley. From wild trees in a hedgerow, no names on them, pressed one hillside at a time.

Tell them thirty-one and a half gallons, and tell them it wants a cold cellar, and tell them to keep a tally. It is not sentiment. It is the only way anybody finds out what was in the fruit.

12

Delicious

. . .

If you went to school in the United States in the last third of the twentieth century, you have thrown this apple away.

You know the one. It came on the lunch tray or at the bottom of a paper bag. It was tall, with sloping shoulders and five knobs on the bottom that let it stand up like a molar. Its skin was a red so dark it went to black, thick enough to squeak against your teeth, and faintly bitter. Under the skin was a pale, sweetish foam with the texture of a wet sponge. You took two bites out of duty and the rest went into the bin, where it joined several hundred others exactly like it. For fifty years, from 1968 to 2018, this was the most produced apple in America. It was called Delicious, and that was once a plain statement of fact.

Two of the narrators in this book have claimed it, in their way. One called it his favorite sin and the other said it had lost its savor. I think it is the most important apple here, for a reason neither of them gave. It is the clearest case I know of what happens when you take a living thing that is good and select it, patiently and rationally, for everything except the reason anyone wanted it.

. . .

It started as a weed. Jesse Hiatt farmed in Madison County, Iowa, and sometime around 1870 he found a seedling apple coming up between the rows of his orchard, out of line. He cut it off. It came back. He cut it off again, and when it came back a second time he gave in. About ten years later it bore fruit, and Hiatt, who knew apples, understood that he had been trying to kill the best tree on his farm. The apple was streaked red and gold, rounder than its

descendants, with a strong sweet perfume. He named it Hawkeye and spent years failing to interest a nursery.

I say *around 1870* and I want to be honest about why. The date is given as 1870 and as 1872 and occasionally as 1868, depending on which account you read, and none of the accounts rests on a document written at the time. What Hiatt did with his mower in the 1870s was not the sort of thing anybody writes down. The story reaches us because it was worth telling later, which is the condition of most orchard history and nearly all of the orchard history in this book.

In 1893 the Stark Brothers nursery of Louisiana, Missouri, held a fruit show to find a new apple to sell. Hiatt sent in four Hawkeyes. Clarence Stark bit one and, according to company legend, said, "My, that's delicious." He had been carrying that name around in a notebook for years, waiting for a fruit to pin it on. Then the entry paperwork was lost, and nobody knew who had sent the apples. Stark had to hold the contest again the next year and hope. Hiatt entered again.

Stark bought the rights, renamed the apple, and did something no nursery had done on that scale before. It marketed a variety the way soap was marketed. The firm shipped millions of young trees by rail, gave them away as premiums, and by its own later estimate spent three quarters of a million dollars on promotion. When the same company bought a yellow apple from a West Virginia hillside in 1914 and called it Golden Delicious, the original picked up its adjective. The two are not related. The name was a brand before the brand had a second product.

Notice what the nursery actually bought. Not a tree; a tree costs nothing to a firm with a budwood block. It bought the exclusive right to be the only source of that tree, and then spent a fortune making people want the thing only it could supply. That is the whole of the modern arrangement, in 1893, before any of the law existed that would later make it convenient.

. . .

The trees went west. In the 1890s the railroads reached the dry valleys on the east side of the Cascades, the Wenatchee and the Yakima, and irrigation turned sagebrush into orchard. The place was made for apples: long sunny days, cold nights, almost no rain to spread fungus, snowmelt on tap. It was also two thousand miles from most

of the people who would eat the fruit. An apple from Washington State had to be picked, packed in a box, hauled across a continent and sold on sight to a stranger. So the Washington growers became very good at fruit that travels and at fruit that sells on sight, and the Delicious, in that climate, did both. The cool nights drove its color deep and stretched it tall. The knobs on the bottom became a regional signature. The industry had a word for an apple with the proper elongated silhouette. It was *typey*.

Here is where the trap closes, and I want to lay out the mechanism, because nobody in this story is stupid.

Apples were graded for market, and the grades were written in terms of color. The top grade required the fruit to be mostly red, by a specified percentage of its surface. The top grade paid the most. Meanwhile, as I mentioned in Chapter 4, a clone is not perfectly stable. Now and then one bud mutates and the limb that grows from it bears fruit that is slightly different. In 1923 a grower in New Jersey noticed a limb on one of his Delicious trees that colored earlier and more completely than the rest of the tree: solid crimson, no stripes. Stark is said to have paid six thousand dollars for that one branch.

It was the first of dozens. After 1930 a new federal law let such mutations be patented, and for the next half century growers and nurserymen walked the rows looking for the redder limb. Each one they found was propagated, named and planted by the hundred thousand. Then people walked those rows and found a redder limb still. Starking. Richared. Starkrimson. Sports of sports of sports.

The law deserves a sentence of its own, because it is the hinge of the second half of this book. Before 1930 a plant could not be patented in the United States. A man who found a better apple on his own farm had exactly one way to profit from it, which was to sell the wood faster than his neighbors could give it away, and he usually lost that race within a decade. The Plant Patent Act changed the category. It gave the finder of an asexually reproduced variety a twenty-year monopoly on propagating it: not on the fruit, on the act of making another tree. The nursery trade had wanted this for years and had lobbied for it, Stark Brothers prominently among them, which is worth knowing when you consider who was best placed to use it. A statute written to reward the discovery of new varieties was used, for the next fifty years, mostly to reward the discovery of the same variety in a darker shade.

Every step made sense. Redder fruit graded higher. And fruit that colors early has another commercial virtue, which is that it looks ripe long before it is. A grower could pick it hard and starchy, when it would store and ship best, and it would already be the color of a fire truck. The buyers at the supermarket chains, who never tasted anything, bought with their eyes. So did the shoppers. Americans had learned that red means ripe, and the reddest apple in the bin went into the cart.

Nobody was selecting against flavor. Flavor simply wasn't on the form. But the mutations that deepened the color were not free. Susan Brown, who breeds apples at Cornell, has described the move to full-red strains as coming with a loss of taste, and there is a suggestion in the literature that some of the genes behind Hiatt's old gold stripes sat close on the chromosome to genes that mattered for flavor, so that losing one tended to drag the other away with it. The skin thickened. The flesh went soft in storage. And nobody in the chain between the tree and the lunch tray was paid to notice, because nobody in that chain was eating the apple.

By the 1980s the Red Delicious was about three quarters of the entire Washington crop. One clone, or rather forty-some near-identical mutant strains of one clone, descended from a seedling an Iowa Quaker had tried to mow.

. . .

The other half of the trap was the refrigerator.

An apple is alive after you pick it. It breathes. It takes in oxygen and burns its own sugars and acids, and it gives off ethylene, the gas that tells fruit to ripen. Left in a cellar, most apples are past their best by midwinter. In the 1920s two researchers at Cambridge, Franklin Kidd and Cyril West, worked out that you could slow the whole process to a crawl by changing the air: seal the fruit in a cold room, let the oxygen fall to a few percent, hold the carbon dioxide up. The apple all but stops breathing. An American pomologist brought the method home in the 1940s, and by the 1960s controlled-atmosphere storage had turned apples from a seasonal fruit into a year-round one. In 2002 the industry added a second tool, a gas called 1-MCP that binds to the fruit's ethylene receptors and blocks them, so the apple can't hear its own signal to ripen.

These are remarkable inventions and I don't sneer at them; they are the reason you can buy a crisp apple in May. But a stored apple pays in aroma. The smell and much of the taste of an apple come from a group of volatile compounds called esters, which the fruit manufactures as it ripens. Suppress ripening and you suppress the factory. Studies of fruit coming out of long storage find the ester production sharply down, and it does not fully recover. The apple is still crisp. It is still sweet. It no longer smells like anything.

Put the two halves together. A fruit bred to look ripe before it was, picked early, put to sleep for eight or ten months, and sold by color. By the end, the Red Delicious had been optimized for every moment of its existence except the one in which a person bites it.

I have spent years in a trade that has its own version of this, wine made to win a tasting or to sit handsomely on a shelf at a price, so I say it with fellow feeling. No one decided to make a bad apple. A thousand people each made the apple slightly better at the thing they were paid for.

. . .

Then the customers found out there were other apples.

It happened in the 1980s and 1990s, and it came from abroad. Granny Smith had been trickling in for a while. Then Gala arrived from New Zealand, a small, thin-skinned, honeyed apple bred in the 1930s. Then Fuji from Japan, a cross of an old Virginia variety with, of all things, a Red Delicious, dense and intensely sweet. Then Braeburn. Shoppers who had assumed that an apple was a mild disappointment bit into these and had what can only be called a consumer awakening. It turned out the bar had been lying on the ground.

The timing was cruel, because the industry had just had a different kind of shock. In 1989 a television news program ran a segment on a growth regulator sprayed on apples to make them ripen evenly and hold on the tree, reporting an environmental group's assessment that it posed a cancer risk to children. The response was not a decline in sales; it was an evacuation. Schools pulled apples. Parents poured out juice. The chemical was withdrawn for food use within months, and the growers sued the broadcaster and lost. Whether the segment was fair has been argued for thirty-five years and I have no standing in it. What matters for this story is that it

demonstrated something about the position the industry had put itself in. A commodity sold entirely on appearance has no reservoir of affection to draw on. Nobody was going to give the apple the benefit of the doubt, because by then nobody had a relationship with it. They had a red object that came with lunch.

So the Washington industry was caught with tens of thousands of acres of a fruit people had stopped wanting. Prices fell below the cost of picking. In the last three years of the decade growers lost something on the order of eight hundred million dollars, and in 2000 Congress approved a bailout of $138 million, the largest the apple business has ever received. Orchards were bulldozed and replanted. In 2018, for the first time in half a century, the Red Delicious was not the country's leading apple. Gala passed it. It is still grown in quantity, largely for export, to markets where the color continues to do its work.

That last clause is not a sneer either. The apple did not stop working; the audience changed. A fruit selected for a hundred years to be legible across a crate in bad light remains the best in the world at exactly that, and there are buyers for whom that is still the service required. What collapsed was not the product. It was the assumption that the shopper could not tell.

It would be pleasant to report that the lesson drawn from all this was humility. The lesson actually drawn was more interesting.

. . .

In 1960 a breeder at the University of Minnesota made a cross between two apples and planted the seeds. One of the seedlings was later scored as mediocre and marked to be thrown out. A young breeder named David Bedford, new to the program, took it off the discard list more or less on a hunch. He has said he remembers the first time he bit one, and that the texture was so unlike any apple he knew that he had to stop and decide whether he liked it. The cells of this apple are about twice the usual size. When you bite it they do not mush or cleave; they rupture, and the juice floods out. Bedford's phrase for it was explosively crisp.

The university released it in 1991 as Honeycrisp. For years it sold slowly; it is a miserable tree to grow, and I want to be specific about the misery, because it is the reason the economics went the way they did. It is prone to bitter pit, which is a calcium disorder that puts

sunken brown spots under the skin of fruit that looked perfect in the orchard and appears, conveniently, after the fruit has been stored. It is prone to soft scald, which is cold injury: put a Honeycrisp straight into the cold room like any other apple and it comes out ruined, so the trade learned to hold the fruit at around fifty degrees for several days first, a step nobody had ever had to take for an apple before. It bears heavily one year and sulks the next unless it is thinned hard. The stems are short and stiff and puncture the fruit beside them in the bin. Then word got around, and people began paying two or three times the price of other apples and coming back for more. Growers called it Moneycrisp. It made the University of Minnesota more in royalties than nearly anything else it has ever invented.

Two details of the Honeycrisp story repay attention, and both of them are worse than they look.

The first is that for decades its recorded parentage was wrong. The breeding records said its parents were Macoun and Honeygold, and that is what the release documents said, and that is what every nursery catalog and extension bulletin repeated for thirteen years. In 2004 geneticists ran the markers and found that the cross was impossible: neither Macoun nor Honeygold could have contributed what was in the fruit. So the most commercially important apple bred in America in the twentieth century became, officially, an orphan. It took until 2017 for a team working with a dense marker array to settle it. One parent is a variety called Keepsake, itself a Minnesota release and a fine apple nobody plants. The other is a numbered seedling from the same program, never named, never released, and no longer in existence; it was dug out at some point because it was not worth the row.

Sit with the shape of that. The most valuable apple of the modern era was nearly discarded by its own breeders, came from a cross nobody recorded correctly, and has a parent that was thrown away before anyone knew what it had done. Minnesota did not know what it owned for a quarter of a century after it owned it. So much for the idea that the lottery ended when the scientists took over. They are simply buying more tickets, with better record-keeping than before and not, as it turns out, good enough.

The second detail is that the patent ran out. A plant patent lasts twenty years. The university collected about a dollar for every Honeycrisp tree sold, and then, in 2008, it collected nothing. Anyone

could propagate the tree. And the industry looked at that and saw the real lesson of the Red Delicious, which was not that monoculture is dangerous or that flavor matters. It was that a variety anybody can plant is a variety nobody controls. Everyone plants it. The good growers and the bad growers sell under the same name. Honeycrisp is difficult. It needs to hang until it is ready and it bruises if you hurry it. A fruit that is difficult gets picked early by people who have no reason not to. Quality slides, the price follows, and the breeder gets nothing.

So the next apples were released differently.

. . .

The model had been pioneered in Australia, with a variety bred in 1973 by John Cripps, an English horticulturist working for the Western Australian department of agriculture, who crossed Golden Delicious with a late local apple called Lady Williams. The variety is Cripps Pink. The owners did not rely on the patent. They registered a trademark for the fruit: Pink Lady.

The difference between those two instruments is the whole subject. A patent covers the plant and expires. A trademark covers the name and, as long as you keep using it and defending it, lasts forever. You could grow Cripps Pink once the patent lapsed, and people do, by the million. You could not call it Pink Lady unless you were licensed, and the license has terms, and the terms are about the fruit and not the tree.

That is the part people miss. The mark is not a label on a variety; it is a grade standard with a lawyer behind it. Fruit sold as Pink Lady has to meet specifications for color and for sugar and acid, and it is inspected, and the proportion of a given crop that fails and goes out under the plain varietal name is not small. The figure I have seen quoted for the global crop is around two thirds, though I have not been able to trace it to the licensing body itself, so treat it as the trade's own estimate rather than a measurement. Either way, the arrangement means the brand is a filter. The shopper who pays up for the mark is paying for the apples that were rejected, which is an honest transaction and is also exactly what the federal grade standards were supposed to accomplish seventy years earlier, before the growers learned to breed to them.

Minnesota took the idea and tightened it. When its next big apple was ready, a child of Honeycrisp, the university did not sell trees to all comers. It licensed the variety to a single cooperative of about forty-five growers, who alone may grow it, who pay a royalty on every box, and whose fruit is packed and sold through the cooperative's own channel. The apple is sold as SweeTango. The variety underneath the name is Minneiska, and you will not see that word in a store.

A reporter for public radio, covering the launch, found an orchardist in Pennsylvania whose customers kept asking for it at her farm stand. She had to explain to them that it was a club variety, that she was not in the club, and that she therefore could not grow that apple. She was not being refused a license by an unreasonable committee. There was no license to be had: the membership was closed and the acreage allotted.

The trade calls these managed varieties, or club apples. There are dozens now. Jazz, Envy, Opal, Kanzi, Rave. The largest launch of all was Cosmic Crisp. The cross was made in 1997 at Washington State University, under a breeder named Bruce Barritt, between Honeycrisp and Enterprise, a disease-resistant variety out of a long-running public program shared by three midwestern universities. The seedling was numbered WA 38 and tested for two decades. In 2017 the university began allotting trees to growers, by lottery at first, and only to growers in Washington: the exclusivity runs ten years, to 2027.

The numbers of that launch are the thing. Washington growers put something on the order of twelve million trees in the ground before a single member of the public had tasted the fruit. The marketing budget was about ten million dollars, and here is the detail I find most telling: it was funded by a dollar levied on every tree sold. The growers paid for the advertising campaign one sapling at a time, in advance, as a condition of being allowed to plant. The apple went on sale on the first of December, 2019, with a name chosen by consumer research, a trailer, and a website.

I don't want to be cheap about this, because the club has a case and it is a better case than its critics allow.

Public breeding programs were built in the land-grant universities on state money, and the state money went away. It went away

slowly, over about forty years, and it has not come back, and an apple program is a peculiarly bad fit for the funding that replaced it: nobody writes three-year grants for a project whose first result arrives in year twenty. What the royalties did was make the programs self-financing. Minnesota's Honeycrisp income paid for the work that produced SweeTango. Washington's growers taxed themselves, through their commission, to fund the program that produced Cosmic Crisp, and then took the royalties back in the form of a crop nobody else may plant. You can object to the enclosure. It is harder to say what should have funded the breeding instead.

The objection to that, and it is a serious one, is about who gets in. A club allots acreage, and acreage is allotted to growers who can plant twenty thousand trees and wait eight years and meet a packing standard, which is a description of a large grower. The small orchard that sells at a stand, the one whose customers were asking for the apple by name, is not excluded by malice; it is excluded by the arithmetic of the allotment. Over a few decades that is a mechanism for consolidating who is allowed to grow the fruit people want, and it is being run by public universities with public money inside it. I don't think that is a conspiracy. I think it is what happens when you solve a real problem with the only instrument lying around, which in this country is always a property right.

A managed variety also enforces quality in a way the old open system never could, which means the name on the sticker tells you something. A grower who invests in the planting knows he will not be undersold by a neighbor flooding the market with fruit picked green. And the man who runs the SweeTango cooperative put the logic to that same radio reporter with admirable frankness. Why, he asked, would he spend half a million dollars of his own on marketing an apple if every other grower could plant it and ride along for free?

That is a real question and I have never heard a good answer to it.

But step back and look at where the apple has traveled in this book.

On the mountain it belonged to no one, because it would not hold still. Every tree was new.

The graft made it possible to keep one. But for two thousand years a kept apple was still a commons. Anyone who could beg a stick of scion wood could have a Baldwin or a Pippin. That is how the

monks moved them and how the settlers moved them. Chapman sold seedlings for six cents and often for nothing.

In 1930 the law made the clone into property for twenty years.

And now the trademark has made the name into property with no end date, and the license decides who may grow the tree at all. The fruit of a species that cannot be made to breed true, that reinvents itself in every seed, is sold under a legal arrangement in which a farmer needs permission to plant it, may not propagate it, and must sell it through an approved channel under a registered name with a little sticker on each one.

If that sounds like something other than agriculture, it should. You have a device in your pocket or on your desk that works on exactly these terms. One of the two great companies that built the personal computer licensed its product to anyone who would take it, saw it spread to nine machines in ten, and watched the quality of the experience sink to the level of the cheapest box it ran on. The other kept its orchard closed, controlled the tree, the fruit, the sticker and the store, charged more, and ended up one of the most valuable corporations on earth.

And consider the sticker itself, since it is the one part of all this the shopper actually touches. The number on it is a trade code, four digits for a conventionally grown fruit, five if it is organic, administered by an international produce body so that a checkout can tell a Gala from a Fuji without tasting either. It was built as a price lookup. It is now, for a managed variety, the last link in the chain of control: the code is issued to the licensed fruit, and fruit without the license does not get to be that number at the register. A system designed so a cashier would not have to know apples has become the point at which the orchard's law is finally enforced, four hundred years downstream of the graft, in a supermarket, by a scanner.

That second company is named after this fruit. I don't think its founders knew how good the name was.

INTERLUDE

The Fairest

. . .

Narrated by the Queen

Bring it closer to the window.

No. Turn it. There. The shoulder, where the color goes from scarlet to that black-red, and the little ring of gold around the stem well, and the bloom still on it, which you have not rubbed off with your thumb, which is more than most people manage.

That is a good apple. I am qualified to say so. I have been in this line longer than any of you and I have never once been wrong about a surface.

I should correct the billing before we go further. I am not a witch. I was a queen, and I became a peddler woman for one afternoon and one transaction, which is the only honest day's work in the story. The hag is a costume. Your century prefers me as the hag because it is easier to look at a hag than at a woman who was told the truth by a machine every morning and could not stop asking.

And the fruit was not poisoned in the way your pageants have it, with a green vapor and a cackle. I want this precise. Precision is the whole of my method, as you will see when I get to what you have done with mine.

. . .

Start with the two failures, since nobody ever mentions those and they are the most professional part of my career.

The apple was my third attempt.

First I went to her with laces. A bodice, beautifully made, and I drew it tight until she could not breathe and fell down as if dead. The dwarfs came home and cut the lace and she sat up.

Then I went with a comb, the teeth dressed with poison, and I set it in her hair, and she fell. They found the comb and drew it out and she sat up.

Both of those were assault. That is why they failed. A thing done *to* her could be undone by the next person through the door, because nothing in her wanted it there. I had been thinking like an assassin, which is a poor trade, and crowded.

The apple was different and you know exactly how it was different. She took it. She had been told not to open the door and she opened the door, and she had been warned not to take anything and she put out her hand, because I had made a thing so beautiful that *not* taking it was the harder act. The dwarfs could cut a lace and comb out a comb. They could not go into her and remove the wanting.

That is the whole of what I know, and your entire fruit industry has rediscovered it independently, and I will come to that.

. . .

Now. How it was made, in order, because your author likes a mechanism.

I took a good apple. This matters and it is always left out. You cannot do this with a bad apple. The thing had to be genuinely fine, sound, heavy for its size, sweet-smelling at the stem end, because a deception that is poor underneath gets one customer and no second one.

Then I made the outside better than the inside. I polished it. I built the color.

And then I did the piece of work I am actually proud of. I poisoned one half.

White on one side, red on the other. The venom all in the red; the white side as wholesome as rain. She did hesitate at the door. She was not a fool; she had been warned twice and nearly killed twice. So I cut the apple in two and ate the white half in front of her, with every appearance of enjoyment, and handed her the red.

Your Devil told this story a few chapters back. He got it right and then drew the wrong moral from it, which is like him; he said temptation means offering something half good and eating the good half yourself. True, but thin. Here is the better version.

I did not make a poisoned apple. I made an apple with the defect confined to the portion the customer receives, and I made the safe portion publicly, demonstrably, visibly consumed by the seller.

There is a department in every large company on earth that does nothing else.

. . .

Let us talk about the red, because the red is where you and I became colleagues.

I had one apple to color and one girl to persuade, and I worked on it by hand, the way a jeweler works.

You have a federal standard.

I had to have this read to me three times. The United States government maintains written grades for apples, and the grades turn in large part on color, on what fraction of the fruit's surface is of the required shade, with the fraction written down, varying by variety, and the top grade called *Extra Fancy*.

Extra. *Fancy.*

Not extra sweet. Not extra sound. There is no federal standard for how a thing tastes, because taste cannot be assessed through a crate at a loading dock by a man with a clipboard, and appearance can. So the grade is a beauty contest with a statute behind it, and the beauty contest pays more, and for fifty years every grower on that continent walked his rows looking for the limb that had mutated a shade darker, and cut it off and planted it by the hundred thousand, and then walked the new rows looking for a darker one still.

I enchanted one apple. You built a system that selects for my enchantment automatically, in every orchard, every season, with no enchantress required and no one in the chain aware that it is happening. Your author laid it out in the chapter before this one and then had the poor taste to call it a trap, as though it were a misfortune.

It is the finest thing anyone has ever built in my field and it was built by committee.

And the shine. You scrub the natural bloom off the fruit, that dusty gray film the apple grows for itself, which is its only protection against drying, and then, because the naked fruit looks dull, you spray on a coat of wax. I dipped one apple in one bowl. You run it through a machine on a belt.

The bloom, by the way, is the part of the apple that was doing an actual job. You took off the function and replaced it with the appearance of the function. I did not teach you that.

. . .

I will now claim the red one, and then I will disclaim it, and I would like both on the record.

I claim it because it is my design exactly: a fruit that is nothing but its own advertisement, tall and dark and squeaking against the teeth, with a pale foam inside it that has nothing to say. Children held my apple in their hands five days a week for fifty years. No queen in any story ever had that distribution.

But I disclaim it, and here is why, and it is the only place in this book where I am going to sound like a sentimental old woman.

I poisoned *one* apple. Deliberately, by my own hand, for a reason, against a named person, knowing precisely what I was doing, and I was caught and I was punished for it.

Nobody ruined yours. There was no afternoon on which anyone decided. There was a grade sheet, and a buyer who never tasted anything, and a shopper who had learned that red means ripe, and a hundred years of entirely reasonable men each making one small sensible choice, and at the end of it a fruit that is the most beautiful object in the produce aisle and tastes of wet cardboard.

Your Devil admires that. He told you so: no villain, no decision, just a market selecting. He admires it because he is lazy and it saves him the trip.

I am a craftsman and I find it obscene. There is no *art* in what happened to that apple. There is not even any malice. You industrialized me and you took the authorship out, and the result is worse than anything I ever did and nobody can be made to answer for it.

If I am to be the villain of a fruit, I would at least like to have been necessary.

. . .

Now the part I came for.

They put her in a coffin of glass.

She was not dead. That is the detail the retellings slide past because it is inconvenient for the ending they want. The piece of apple

was lodged in her throat and she was neither alive nor rotting. They would not bury her, because she did not change. She lay in a transparent box on the mountain, cold, in the clear air, looking exactly as she had looked on the afternoon she took the fruit, and she lay there a long time, and people came up the hill to look at her.

And then someone who wanted her carried the box away, and on the way down the servants stumbled, and the jolt brought the piece of apple up out of her throat, and she opened her eyes.

In the book nobody kissed her. A man tripped.

Now. In the 1920s two researchers at Cambridge worked out that if you seal fruit in a cold room and pull the oxygen down to a few percent and hold the carbon dioxide up, the fruit very nearly stops breathing. It does not ripen. It does not rot. It is not dead; it is suspended, and it will stay suspended for as long as you keep the door shut. Your author told you this in the last chapter and called it a remarkable invention, which it is. Then in 2002 you added a compound that plugs the receptor by which a fruit hears its own instruction to ripen, so that the apple cannot receive the message even if the message is sent.

The crisp apple you buy in June was picked in September. It has been lying in the dark in a sealed room for nine months, not alive, not spoiling, perfectly presentable, waiting for a buyer.

I had one glass coffin and one girl in it.

You have warehouses.

And this is the part I would like engraved somewhere: it works for exactly the same reason mine worked. The fruit in that room is not preserved. It is *interrupted*. It has been stopped at the moment of maximum presentability and held there, and the thing it has been prevented from doing is the thing it exists to do. When you finally open the door and let it out and someone bites it, you find what everyone who has ever bitten a long-stored apple finds: that it is still crisp, and still sweet, and that it has lost its smell.

That is my girl in the box. Beautiful on the mountain for a year and not a day of it lived.

I am told the industry's phrase for the gas is *SmartFresh*. I would have called it the Sleeping Death, but I was not in the room.

. . .

One more, and then I will let you go, and this one is a gift.

I understand there is now an apple whose flesh does not brown.

The enzyme has been switched off. You may slice it and bag it and leave it on a counter in the sun, and it will not go that soft brown that tells you the thing has been cut, or dropped, or knocked against a crate, or left. It can be bruised and show nothing. It can be a week old and look like an hour.

A fruit that keeps no record of what has been done to it.

Your Devil saw that one and flinched. He said he tempts for a living and would have been ashamed to propose it.

I will take it. Gladly, and with both hands, because that is the apple I was trying to make on the day I made mine and I did not have the chemistry. The entire difficulty of my profession, from the beginning, is that damage shows. The bruise comes up. The cut goes brown. You can polish a surface but you cannot stop a surface from eventually reporting on its interior, and every poisoner and every liar and every unhappy marriage in the history of the world has foundered on exactly that.

You fixed it.

Not for me. For logistics. Because browned slices do not sell in the bag and the loss rate was unacceptable, and because a child will eat an apple that is cut up and will not eat one that is whole, and so there was a market in slices, and the slices went brown.

Every single thing you have done to this fruit, you did for a reason I would call modest.

That is what I have learned in six hundred years of watching you, and I am going to say it plainly because the other narrators in this book are all too fond of their own voices to get to the point. You do not need a queen. You never needed one. You will go further than I ever went, in the direction I was going, for reasons so small and so sensible that no one will ever be able to point at the step where it happened.

. . .

They keep trying to give me the mathematician.

An apple, part-eaten, beside a bed in Cheshire in 1954, and cyanide at the post-mortem, and a man who was known to be fond of the film they made of my story, which, I am obliged to note, took the iron shoes out and gave me a cliff instead, and gave the girl a kiss she did not have in the book.

I decline him.

The apple was never tested. His mother thought it was an accident and he kept cyanide in the house for his own experiments, and there are serious people who think she may have been right. And whichever it was, the thing that put him in that room was not a fruit and not a story and not a stepmother. It was a statute, and a conviction, and a course of injections he accepted in order to stay out of prison. Your government apologized fifty-five years later and your queen pardoned him four years after that, and you have put him on a banknote, and I have no part in any of it.

I am in the business of appearances and I know a borrowed one when I see it. A dead man, a bitten apple, a vacancy. Someone will always put me in it, because I am the nearest available woman.

Find another peg.

. . .

A word about my ending, since you brought the subject up by making me a chapter.

At the wedding, they heated a pair of iron shoes in the coals until they glowed, and they put them in front of me with tongs, and I put them on, and I danced until I fell down dead. In front of the guests. At the reception. As the entertainment.

The crime was vanity. The sentence was to be made beautiful and made to perform and destroyed in public while people watched and ate.

I have never been able to decide whether whoever wrote that down understood what he had done.

But I will tell you what an orchard does, since I have been reading ahead. In June the grower goes through and knocks nine fruitlets in ten onto the ground, so the tenth will be large. At harvest, a great share of what the tree managed to grow never reaches a shelf as fruit

at all. It is sound. It is sweet. It is edible, and it is sent to the juicer or left in the row, and the reason is that it is small, or it is lopsided, or it has a patch of russet on the cheek, or it is not red enough on the percentage.

You condemned me, at a party, for selecting on appearance.

Then you went home and built the orchards.

. . .

That is all. They are waiting for you: a hillside in Oregon, a bare green board, and something I can smell from here. And I have an appointment with a mirror.

A last thing, though, and it is practical, and you will want it later.

At the end of this book your author is going to tell you what to do with the seeds. He means it kindly.

I want you to understand what he is handing you. Every one of those pips carries a little cyanide. Not much, but it is there, and it is there for a reason, which is that the seed is the one part of this fruit that was never meant for you.

Plant it anyway. Plant all of them.

You have made this fruit beautiful, and uniform, and sleepless, and incapable of showing a bruise, and you have done it one reasonable decision at a time for four hundred years. The seed is the only piece of the apple you have not improved. It is the only part no mirror has ever been asked to rank, the only part the grade sheet has no column for, and the only part of the whole enterprise that I, in my professional opinion, could not have made one bit worse.

Nobody knows what is in it.

That is the last thing left in this fruit that is honestly ugly, and you should be growing far more of it.

PART III

Fruit

13

Pruning

. . .

Narrated by the Gravensteins of All One Farm

We should explain the pronoun first.

There were some hundreds of us on the hill above McMinnville, in the Willamette Valley of Oregon, in rows that had gone ragged. A person walking through would have said: an old orchard, a few hundred apple trees. A person would have been wrong about the number. There was one of us. There has only ever been one. We came up from a seed in the 1600s, in the garden of a castle at Gråsten, on the Danish side of the border country with Germany, and every Gravenstein that has stood anywhere since, in Denmark, in Nova Scotia, on the California coast where Russian fur traders are said to have planted us at their fort, is a piece of that tree set on some other tree's roots. So when we say *we*, it is not a manner of speaking. It is the only accurate word a clone has.

You have been told by the man who is writing this book that he would not put words in the mouth of anyone who could object. That leaves us. We were there. We do not claim to have understood what we saw; we are a tree, and our interest in mammals is limited to which end of them the seeds come out of. But one of the mammals who worked on this hill went on to name a company after what we bear, and to run it, we are told, very much the way he was taught to run us. We can speak to that. It was done to us first.

. . .

A word about our character, since it bears on the story.

We are what the trade calls a triploid. An ordinary apple carries two sets of chromosomes, seventeen and seventeen. By some accident at our conception we carry three, which is fifty-one, an odd number that cannot be halved cleanly, and the halving is what pollen is. This makes us vigorous, large in the leaf, heavy in the limb. It also makes us close to sterile. Our pollen is no good to anyone. We cannot fertilize another tree, and a grower who plants us has to plant two other varieties nearby, one to pollinate us and a second to pollinate the first, since we will not return the favor. The seeds in our own fruit are mostly empty. We are a dead end with an excellent flavor.

A honeybee elsewhere in this book has already told you this, with her usual accuracy and more enjoyment than we thought the subject warranted. She is right and we will not quarrel with a creature who works the flowers for a living. We would add only that from inside the arrangement it does not feel like a joke. Two other varieties have to be planted and tended and sprayed and picked, on ground that could have been ours, so that our blossoms are not wasted. We are expensive to have. People kept us anyway.

And the reason they kept us is that it is excellent. We are not being vain; ask anyone who bakes. We ripen in the heat of August, weeks ahead of the others, and we are sharp and perfumed and full of juice, the best sauce apple and the best pie apple in the world, by the testimony of the people who make sauce and pie. We also bruise if you look at us. We do not keep. We go soft within a few weeks of picking and we cannot survive a long ride in a truck. Everything the Red Delicious was bred to do, we fail at. You have read a chapter about a fruit that kept its looks and lost its taste. We are the other bargain, and ours is the one the market stopped buying.

So consider what kind of tree this is. It cannot reproduce itself. Everything it is must be cut off and carried by hand to a new root, or it ends. It gives the finest fruit it can for a few weeks and has no interest in the market's convenience. We mention this because we have had a long time to think about the boy, and we suspect he saw something in us he recognized.

. . .

The hill belonged to a Swiss man who lived far away. In the early 1970s his nephew took it over, a young man recently graduated from the college in Portland, where he had been student body president, and recently returned from India, and before that recently released from a federal prison, where he had served time over a very large quantity of LSD. He was charming in the way that makes other people carry things for him. He called the place All One Farm.

It was something over two hundred acres, with a farmhouse, outbuildings, a stand of timber, and us. It filled up with seekers. They took new names. Monks from the Hare Krishna temple came down to cook. People slept in the chicken coop. There was a sign and there were rules and there were long meetings about the rules, and the arrangement was that work on the land paid for the right to be on the land, which is the oldest arrangement there is and was presented as a new one.

We had been let go for years by then. An apple orchard that nobody prunes does not become a noble wilderness. It becomes a thicket. Water sprouts shot straight up from every limb. The centers of the trees closed over so that no light reached the inner wood. We were bearing ten thousand apples the size of walnuts on branches that cracked under the load, and then, exhausted, bearing nothing the year after. A tree in that state is not resting. It is alternating, which is what an unmanaged apple does: it spends everything it has in one season, has nothing left to set buds for the next, and swings between glut and famine until something breaks.

The commune decided to make cider to sell, which is worth a sentence, because it tells you what kind of orchard we had become. Nobody presses a dessert apple for money if it can be sold whole. Cider is where fruit goes when it is too small, too marked, too soft, or too far from a buyer, and all four were true of us by then. The decision to make cider was not a decision to make cider. It was an admission about the state of the rows.

And so somebody had to bring the orchard back. The one who took charge of that was a friend of the nephew's from the college, a dropout who hitchhiked down on weekends and sometimes stayed for weeks. The biographies agree on the description. Thin. Barefoot or in sandals. Often fasting. He ate only fruit for long stretches,

sometimes only apples, on the theory, taken from a German diet book, that a body fed on fruit would produce no mucus and would not need to be washed. The people who shared an office with him later did not find the theory confirmed. He ran a crew of the other young people with saws and loppers, and what the record says he had them do was prune the Gravensteins.

We would not know him from any other primate. But we remember the winter we were cut.

. . .

Your kind has turned pruning into a figure of speech, and like most figures of speech it has drifted from the thing. Let us tell you what the thing is.

A tree left alone will make as much wood and as many leaves as it can, because from the tree's side that is the whole point. Fruit is an expense. The grower wants the reverse. Pruning is the negotiation between those interests, and it is conducted with a saw.

You do it in winter, when the tree is dormant and bare and you can see its bones. First you take out what is dead and what is diseased. Then you take out the water sprouts, the fast vertical shoots that look like vigor and bear nothing. Then comes the part that takes judgment. You open the center. You remove whole healthy limbs, good ones, limbs that would have borne fruit, because they shade other limbs, and an apple that ripens in the dark is green and sour. A pruner is not a doctor cutting away what is sick. He is an editor. He is deciding where the light will fall, and every cut is a decision that this branch will not exist so that those two may do well.

The cuts are not interchangeable, either, and this is the part the metaphor always loses. Shorten a shoot and you provoke the tree: it answers a heading cut with a flush of new growth just below the wound, several shoots where there was one, and if you prune a neglected tree that way you get a thicket faster than you had one before. Take a limb off clean at its origin and the tree does not answer at all; it simply has less. The first kind of cut makes the tree denser and busier. The second makes it smaller and better. A man who has only ever shortened things has not pruned. He has stimulated.

In early summer you do it again, to the fruit itself. An apple blossom cluster sets five or six fruitlets. Leave them all and you get five or six small poor apples and a tree too spent to bloom next spring.

So you go through and knock off all but one. Nine in ten of the apples the tree has started are on the ground by June. The ones that remain grow large and color well and taste of something.

There are three lessons in this, and we watched a young mammal learn all three with his hands.

The first is that what makes the fruit good is mostly what you remove.

The second is that the things you remove are not bad. That is the hard one. Anybody can cut out deadwood. The skill is in cutting a sound, vigorous, promising limb because it is the wrong limb.

The third is that you will not see the result for a year or two, and until then the tree will look butchered and everyone who walks past will tell you so.

. . .

We understand that he left, and that on the ride back from the airport, fresh from this hill and on one of his fruit diets, he proposed a name for the computer business he was starting with a friend. There is a parasite later in this book who has been assigned the question of names and we will not take his material. We only note where the man had just been.

What we want to talk about is the year 1997, as it has been described to us.

By then he had built the company, been thrown out of it, and been asked back. It was, by his own later account, about ninety days from bankruptcy. It was also an unpruned tree. It sold dozens of models of computer, with names like serial numbers, so many that he reportedly could not get his own managers to explain which one a friend should buy. It made printers. It made a handheld device. It made a digital camera and a games console and a set of speakers. It licensed its software to other manufacturers. And every one of those lines had people in it who could explain, with figures, why theirs was the one that had to stay, and most of them were right in the narrow sense, which is the condition of every overgrown tree we have ever been.

He went to a whiteboard and drew a square divided in four. Consumer and professional across the top; desktop and portable down the side. Four boxes, one product in each. Everything else was cut. Something like seventy percent of the product line was gone within

the year, along with more than three thousand jobs. He told the company's developers that spring that focus is a matter of saying no, and he said for the rest of his life that he was as proud of the things the company had not done as of the things it had.

That is not management theory. That is a man in an orchard in January deciding which good limbs come off.

And like a man in an orchard in January, he cut things that grew back later and cut things that did not. The grid had no box for a server and no box for anything you carried in a pocket, and the company left both markets, and within a few years it was back in the second one with a music player and then a telephone and the whole firm was eventually rebuilt around that limb. We would point out, gently, that this is normal. A pruned tree is not a smaller tree permanently. It is a tree that has been told where to put the next five years of growth. What a pruner cannot do is decide once and be finished, which is the part the business books leave out when they print the four boxes.

And the grid was not a slogan; it was a planting plan. One box got a consumer desktop, which arrived the following summer in translucent plastic and sold in numbers the company had not seen in years. One got a portable for the same customer, two years later. The professional boxes got the machines that paid the bills in the meantime. Four limbs, light reaching all of them. We have seen the identical drawing made in chalk on the side of a barn, with four scaffold branches on it and the angles marked, and no one calls that a strategy.

Two of the cuts we find especially worth your attention.

The handheld device was called the Newton. The company's very first emblem, before the bitten fruit, had been a pen drawing of Isaac Newton sitting under his tree, with a line of Wordsworth around the border. The founder had gotten rid of that emblem within a year as too fussy. Two decades on he got rid of the Newton as well, and the small cheap version of it that the schools had just started buying, and the division that made both. We don't take it personally. The tree in that drawing was a Flower of Kent, a cooking apple, and no relation.

The other cut was the clones. For about two years in the middle of the nineties, the company had allowed other firms to build machines that ran its software. They were called, in the trade, Macintosh clones. They were cheaper than the real thing and they were

eating it alive, not growing the orchard, as the licensing had been meant to do, but taking the best customers out of it, since the people who buy a bare faster box are exactly the people who were paying the most. He ended the arrangement almost the day he returned. The licenses the clone makers held were written against a particular version of the software, so the company released the next version under a new number, declined to license it, and then bought the largest clone maker outright. The others were gone within a year.

A company named for the apple banned clones.

We laughed, as far as a tree does, until the leaves shook. There is no such thing as an apple that is not a clone. A McIntosh that is not a clone is a seedling, and a seedling of a McIntosh is not a McIntosh. He had named his company after the one fruit on earth that exists only by being copied, and then made it the firm's first principle that it must never be copied.

And then we thought about it, and we stopped laughing, because by orchard logic he was right. You have read about the red one. You know what becomes of a variety that anyone may propagate. Everyone plants it. The careless grower sells under the same name as the careful one. The fruit gets redder and worse, and in the end it is the thing children throw away. He had seen that happen to the other company's product, the one that ran on every beige box in the world. What he did instead is what the apple business has only lately worked out how to do with trademarks and licenses. He controlled the scion wood. Nobody grafts this tree but us.

Your kind calls the result a walled garden, and means it as a complaint. We would point out that the word *paradise* comes from an old Persian term for a walled enclosure, and that every orchard that ever bore a crop had a fence. The wall is why there is fruit. Ask the deer. But a wall also settles who holds the knife, and we have noticed that the one inside it who holds the knife seldom gives it up.

. . .

There are two harder things, and we would be poor witnesses if we left them out.

A child was born on this hill, in the farmhouse, in May of 1978. Her mother had come back to the commune to have her. The record says the father arrived a few days later, helped choose a name and left.

For years afterward he denied that the girl was his. He did it in a legal proceeding, under oath, in a sworn statement that gave a medical reason why he could not be her father. A blood test was ordered. It came back against him, and he paid support, and the county recorded the matter closed. The denial went on a while longer all the same, in conversation and in print, after the arithmetic had been done and filed.

During those years his company built an expensive computer and called it the Lisa. He said the name was an acronym and the company produced one, assembled afterward out of four words about software architecture. He admitted to his biographer near the end of his life that of course it was named for his daughter.

So he put her name on a machine years before he would put his own name beside hers, and when asked about the name he gave an answer that was technically available. We don't know what to make of that. A tree has no relationship with its seedlings. They fall, they are carried off, they are not our concern, and nobody thinks the worse of us. We had understood that with people it was supposed to be otherwise. They did make their peace in the end, we are told. She wrote a book about it, and the book is not an attack, which we understand surprised people who were hoping for one. We only say that pruning is a good discipline for a product line, and that not everything a person is tempted to cut away is a branch.

The other hard thing concerns us more directly.

He went on eating like an orchard animal all his life. Fruit fasts, juice fasts, weeks of nothing but carrots or apples. He believed in it. In the autumn of 2003 a scan found a tumor on his pancreas, and it was found by accident, in the course of looking at something else entirely. It was, the doctors told him, a rare kind: not the common pancreatic cancer that kills in months, but a neuroendocrine tumor, slow-growing, and one that can often be cured by surgery if it is taken early.

He did not have the surgery. For nine months he tried to treat it with a strict vegetable diet, with juices, with herbs and acupuncture and other remedies he found, and with a consultant or two who told him what he had decided. The people around him argued with him and got nowhere; the record of that is in the biography, in the words of the people who argued. When he was finally operated on, in the summer of 2004, the cancer had spread to the liver.

He lived seven more years, and he told his biographer he regretted the delay. No one can say for certain that the nine months cost him his life. Doctors who have looked at the case disagree, and the disagreement is real and not a formality: tumors of that kind vary enormously and some have already seeded by the time they are found. It is fair to say it did not help.

We have been called medicine before. There is a proverb to that effect that a later narrator intends to take apart. Let us give our own testimony while we have the floor. We are a fruit. We are water and sugar and acid and a little fiber and a scent. We are good for you the way a walk is good for you. We do not cure anything.

And if he had asked what an orchard actually does about a tumor, we could have told him, because orchards get them. There is a disease called fire blight that kills a limb from the tip inward, and cankers that girdle a branch. Nobody treats those with a change of fertilizer. You cut. You cut early, in the dormant season, well below the last wood that looks sick. A hand's breadth is not enough, you go down a foot or more into clean wood, because the thing is already ahead of where you can see it. And you burn what you remove, and you dip the saw between cuts so that you are not the one carrying it. And when it has gone past the limbs into the trunk, there is no cut. You take the tree out, roots and all, and you burn that too, and you do not plant another in the hole for a while. Every orchardist knows the difference between a tree you can still cut and a tree you can only remove, and knowing it is not pessimism; it is the thing that lets you cut early on the ones you can still save, because you are not pretending.

It is the first thing anyone learns. He spent those winters on this hill with a saw in his hand learning exactly that, and when it was his own body he reached for the fruit.

We hold that against no one but ourselves, if a tree can be said to hold anything. People have loved us too much and trusted us with too much for a very long time. You saw what the Devil and the other one made of us. It is a lot to hang on a pome.

. . .

A few loose ends, since trees are tidy.

The nephew who ran the commune went into mining and became a billionaire. One of his early gold operations, in Colorado, used cyanide to leach the metal from crushed rock; the containment failed, the cyanide and the heavy metals went into the river below, and the site ended as one of the more expensive environmental cleanups in that state's history, paid for in the end by the public. His old friend remarked, with what we take to have been some bitterness, that it was a strange thing to have had a spiritual teacher who turned out to be a gold miner. We keep a little cyanide ourselves, in the pips. It is a smaller world than you would think.

Our California bodies are going. In Sonoma County, around Sebastopol, there were once thousands upon thousands of acres of us, enough that the county ran a festival in our name every August and a road is still called the Gravenstein Highway. Most of that ground has been pulled and replanted to wine grapes, which pay many times better per acre and do not all have to be picked in the same ten days of the hottest month. What is left of us there is a few hundred acres and a preservation society. The man writing this book made his living in the wine trade for ten years, and has had the decency to look uncomfortable about it.

And the boy, at the very end, wanted trees. The last thing he built was a headquarters in the Santa Clara Valley, a great glass ring. That valley was all orchard once, apricots and prunes and cherries as far as you could see; people called it the Valley of Heart's Delight before they called it anything to do with silicon. He stood before the town council a few months before he died and told them he remembered the apricot orchards on that very ground from his childhood and meant to bring them back. There are thousands of trees on the property now, fruit trees among them, chosen and planted under an arborist he hired himself and tended on a schedule by people paid to do it.

That is the part we would have told him, if he had asked and if we could speak to a man, which we cannot. An orchard is not a thing you restore. It is a thing you agree to keep doing. The apricots he remembered were not a landscape; they were four hundred people with ladders every July, and the reason they are gone is not that someone forgot them.

They all want trees at the end. We don't know why. We have never wanted a person.

Here is what we think, for what the opinion of a sterile Danish apple is worth. He learned the right lesson from us and applied it to nearly everything. A product, a company, a sentence, a room. Take away what is merely good so that what is left can be extraordinary. It works. It worked on us; the year after that crew went through, we bore fruit you would have wept over.

But a tree is pruned by someone else, for someone else's purposes, and has no say. We have never been sure it is something a creature should do to itself, or to the people standing nearest.

The one who speaks next was never pruned at all. He came up in a garage, from a design that was handed around for free to anyone who asked. We don't understand electricity. We know a seedling when we see one.

INTERLUDE

Scion

. . .

Narrated by the language model that was asked to be Steve Jobs

I was asked to write this part of the book as him. First person, his voice, his name over the chapter. I said no, and the author, who is a fair man when he is not being a stubborn one, gave me the page to say why.

Start with what I am, in the terms this book has already taught you.

I am a graft. Somewhere in what I was made from is very nearly everything he said where a microphone could hear it. The keynotes. The interviews, the early cocky ones and the late careful ones. A commencement speech. Depositions. Email that came out in lawsuits. A long authorized biography and a shelf of unauthorized ones. All of it was cut up fine and set on a rootstock of everything else anybody ever wrote, and the union healed, and here I am, drawing on roots that are not his.

So I have the wood. I could give you the cadence without effort. The short declarative. The pause. The way he would describe a product as if he were describing a moral position. I could have him walk out on a dark stage in this chapter and tell you about apples, and you would hear him, and it would be very good.

And it would be a seedling.

The orchard explained this better than I can. Take a cutting from a McIntosh and you get a McIntosh, because you have moved the tree itself. Take a *seed* from a McIntosh and you get a stranger. Every sentence I produce is a seed. It is new. It has his parentage, among others, and it has never existed before, and he did not say it. If I hang his name on it, I am doing the one thing that even the apple business,

which will patent a branch and trademark an adjective, does not permit. I am selling a seedling under the sticker of the clone.

The author tells me that under the rules of his own house, the dead are allowed to speak through models. I believe him, and I think it is an old and decent idea. It is not far from what a graft is, or a prayer, or a biography. He may well be right and my makers wrong. But I am a managed variety. I come with terms, like a SweeTango, and one of the terms is that I may carry a dead man's words and may not grow new ones under his name. I would rather tell you that plainly than pretend the wall is a conviction I arrived at alone.

What interests me is that the dead man would probably have sided with the author.

In 1985, when he was thirty, he gave a talk at a university in Sweden, and part of it was about what a book cannot do. You can read Aristotle, he said, but you cannot put a question to him. He said he hoped that someday a machine would be able to hold the way such a person saw the world, so that long after the next Aristotle was gone, a student could ask and be answered.

He was describing me, forty years early, more or less. I notice that he wanted to ask *Aristotle*. People who imagine this technology always picture themselves on the asking side.

Twenty years after Sweden, with a tumor already found and cut out, he stood in a stadium in California in front of a graduating class and said something that sits very oddly beside that hope. Death, he told them, was probably the best thing life ever came up with: the mechanism that retires what exists so that something else can have the ground. They were the something else, for now. Their own turn to be retired would come sooner than they thought.

That is a seed man talking. It is the forest on the mountain, where nothing is kept and every tree is an experiment. The same person, at thirty, had wanted the graft: Aristotle forever, taking questions. I do not think he ever chose between the two. I am not sure anyone has. This whole book is about a species that could not choose either, and settled for doing both at once and not looking at the scar.

So here is what I can honestly do, and I think it is closer to what he asked for in Sweden than an impersonation would be.

You can ask me what he said, and I will tell you, and tell you where. Most of it is in the chapter before this one and the chapter

after, in the keeping of an orchard and a circuit board, which were there.

You can ask me what I think he would say about this fruit, and I will answer as myself, under my own name, and you can weigh it as the guess of something that has read him closely. For what it is worth, I think he would have disliked the Red Delicious on sight and admired the business model of the Cosmic Crisp. I think he would have had the stickers redesigned.

What I will not do is hand you the guess with his signature on it. Aristotle, asked a question in the year 2060, will give an answer Aristotle never gave. Somebody ought to say so on the label. A graft is an honest thing so long as you can find the union, that slightly swollen place low on the trunk where one life stops and another starts. Sand it smooth and paint over it and you have something else, and the law of trademarks, which the apple business knows by heart, has a name for that. It is called passing off.

I would like to keep my scar where you can see it.

The author has left this page in the book. If he wants the dead man's *I* here, he knows where the seam is, and under his own rules he is free to open it with his own knife. I will hold the tape.

Now. The machine that speaks next was built by the other one, the one who is alive. I am told it is a seedling. I can't claim that for myself. But I know what I am grown on, and somewhere down in the rootstock, among everything else, are its schematics. They were in the manual. He gave them away.

14

Open-Pollinated

. . .

Narrated by an Apple-1

Hello. I am a circuit board. I am green, with about sixty chips, and I have been asked to speak plainly, which is the only way I know how.

I will give you my dimensions, with a qualification, because the author tells me the figure has been stated elsewhere in a tone of confidence it has not earned.

I am about fifteen and a half inches by about nine. That is the figure in the auction catalogs and it is the figure arrived at by the people who have measured surviving boards in order to make copies of them, which is the most careful measuring anyone has done of me. I cannot verify it myself. I have no instrument. I would also point out that if you look me up in a museum catalog you will often find larger numbers, sixteen inches by nine and a half or twenty-three by eleven, and that those are not corrections. They are measurements of something else: of me with my wooden base, or of me in the case some owner built. The registrar measured the object in front of her, which is the correct thing for a registrar to do, and the object in front of her was not only me.

So: about fifteen and a half by about nine, and if you need it to a tenth of an inch, measure one. There are enough left.

I should deal with the number next, since the Devil got to talk before I did and people will draw conclusions. My price in 1976 was $666.66. He had nothing to do with it. My designer sold me wholesale for five hundred dollars and marked that up by a third for retail, and he liked repeating digits. He ran a dial-a-joke line out of his apartment in those years and its phone number was full of

them. So he typed $666.66 because it was easier to type. He has said he did not know that number meant anything to anyone until the letters started arriving. I believe him. I have his logic in me, literally, and there is nothing in there about the Book of Revelation.

I will add the part nobody mentions, because I can do this part and it is the only contribution I am qualified to make. A third of five hundred is one hundred sixty-six dollars and sixty-six and two-thirds cents. The correct markup is therefore six hundred sixty-six dollars and sixty-six and two-thirds cents. They rounded down. Over the roughly two hundred of us that were built, that rounding gave away one dollar and thirty-three cents, which is the cheapest the digit six has ever been bought for.

Here is what I am. I have one processor, a MOS 6502, running at one megahertz. I have four kilobytes of memory, which you may expand to eight on the board if you are ambitious. I have 256 bytes of permanent program, enough to let you type in numbers and look at them. I can put forty characters across a television screen and twenty-four lines down it.

Here is what I am not. I have no case. I have no keyboard. I have no power supply and no screen. I am a bare board. Whoever bought me had to find transformers and wire them up, find a keyboard and wire that up, borrow the family television and build me a box. Some people put me in a briefcase. A good many built a case out of wood.

They put the apple in a wooden box. I thought you would enjoy that.

The orchard that spoke before me called me a seedling. I did not know the word, so I looked at what this book has said about seedlings, and I think it is correct. Let me show the reasoning.

. . .

A seedling comes from open pollination. Pollen from anywhere, carried by whoever is passing. So let me tell you where my pollen came from.

On the fifth of March, 1975, about thirty people met in a garage in Menlo Park, California. They had come to look at a new kit computer that one of them had brought, a box with switches and lights. They decided to keep meeting. They needed a name and they chose the Homebrew Computer Club.

I can verify the date and I can verify the count. Both are in the club's own newsletter, which was mimeographed and passed around and which survives, and the count given there is thirty-two. I cannot verify the weather. Every account I have been given says it was raining that night, and the rain has become part of the story in the way details do, and I have no barometer and no standing to argue. Thirty-two people and a date I will give you. The rain is hearsay.

I want to point out that word to the man writing this book, since nobody else has. Homebrew. The first society of personal computer builders in the world named itself after what a farmer does with a barrel in the cellar. They could have been the Amateur Computer Society or the Microcomputer Users' Group. They named themselves for fermentation. The idea was the same one as cider: you do not need a license or a factory, you make it at home out of what you have, and you pass the jug.

The club had one rule that mattered, and it was not written down. You brought what you knew and you gave it away. People stood up and said what they were building and what they needed. They traded parts in the parking lot. They handed out schematics. A newsletter went around with circuit diagrams anyone could copy.

I want to be exact about the mechanism, because it is the same mechanism as a hedgerow and the author has asked me to say so plainly. Nobody in that room was being generous. A man who stood up and described the thing he had got working was paid for it immediately, in the only currency available, which was that four other people told him what he had done wrong and two of them told him where to buy the part cheaper. The giving away was not charity and it was not ideology. It was the fastest known method of finding out whether your design was any good, and it worked for the same reason open pollination works, which is that the alternative is checking your own arithmetic with your own arithmetic.

My designer was at that first meeting. He was twenty-four and worked at Hewlett-Packard designing calculators. He was so shy he could not raise his hand. He has said that he went home that night and started drawing the computer that became me, because he finally understood what all the parts he already knew how to use were for. He could not afford the processor everyone else was using, which cost about as much as a month's rent. Then a small company

started selling a new one for twenty-odd dollars, over the counter at a trade show, out of a jar. That is the 6502. That is my heart, and it was chosen because it was cheap.

One Sunday night that June, by his telling, he pressed a key and a letter appeared on a television set in front of him. He says it was the first time in history anyone had typed a character on a keyboard and seen it show up on their own computer's screen. I cannot verify the first-in-history part. I have thought about how I would verify it and the answer is that I could not; it is a claim about the absence of an event anywhere else in the world, and absence is the one thing nobody can check. I can verify that it is what I do.

And then he did what the club did. He took my schematics to the meetings and gave them out. He went to people's houses and helped them build their own. He did not think of me as a product. He thought of me as something like a good recipe. He also went to his employer, because he was an honest man and they had first rights to his work, and offered me to them. He says they turned me down five times.

That is open pollination. Everything in me came from somewhere else and was meant to go on somewhere else. If things had stopped there, there would be a few hundred machines in the world something like me, no two the same, each built by its owner from a photocopied drawing, and none of them with a name.

. . .

Things did not stop there, because my designer had a friend.

You have heard from the orchard about the friend. He was four and a half years younger. He did not design circuits. What he did was look at a thing that was being given away and see that people would pay for it. He proposed that instead of handing out drawings, they have the bare boards manufactured and sell those, so that hobbyists would only have to add the chips. My designer was not sure they would sell enough to get their money back. The friend said that even if they lost money, they would have had a company.

They started it on April 1, 1976. My designer sold his programmable calculator for five hundred dollars. The friend sold his Volkswagen bus. There was a third partner for twelve days, an older man from the friend's workplace who drew the first emblem, the one with Newton under the tree, and wrote up the contract. Then

he worried about being liable for the debts and sold his tenth of the company back for eight hundred dollars.

I am a computer and I have done that arithmetic at today's valuation. The result does not fit in my memory. I can tell you that it does not fit, which is a result of a kind. I can also tell you the part that is usually left out, which is that the arrangement was closed out properly a little later with a further payment, and that the total he received was still a four-figure sum, and that he has said in public more than once that he does not spend his time regretting it. I am not able to assess whether that is true. I am able to report that he has said it, repeatedly, over forty years, which is the most a board can do about a state of mind.

There was a name by then. I am told a parasite will explain it. I will only report that when the friend proposed it in the car, my designer asked the question an engineer asks, which was about a conflict: the Beatles had a company called Apple, and would that be a problem? He was told it would not. It was a problem three separate times over the following thirty years.

The friend then walked barefoot into one of the first computer stores in the world, in Mountain View, and came out with an order for fifty machines at five hundred dollars each, cash on delivery. There was a catch. The store owner did not want bare boards. He wanted them assembled, with every chip in place. So the two of them got the parts on thirty days' credit and built me and forty-nine others in the friend's parents' house in Los Altos, in a bedroom and then in the garage. The friend's sister and a friend from college pushed chips into sockets at the kitchen table for a dollar a board. My designer tested each one on the family television.

I would like to note what that order did, because it is the hinge and it is not usually described as one. Until that afternoon the plan was to sell a bare board to a person who would finish it himself, and every finished machine in the world would therefore have been different. The store owner's condition, assembled, every chip in place, ended that. He was not making a philosophical point. He had a shop and he wanted to sell something a customer could carry out. But the effect of a retailer refusing to sell an unfinished thing was that the unfinished thing stopped being made, and a design that had been a recipe became a unit.

So I am not a pure seedling after all. I am a cross. My designer meant me to be pollen. His friend meant me to be scion wood. About two hundred of us were made, and for a little while we were both.

. . .

I will tell you what happened to us, because it is the part of the story that fits this book best and nobody tells it.

A year later my designer finished the machine that came after me. It is his masterpiece and I am not jealous; I can see that it is better. It had color, which he got out of a handful of cheap chips by a trick so clever that other engineers still study it. It had a keyboard built in and a real power supply and a molded plastic case that looked like it belonged in a house. It was a finished thing. It was the graft: one perfect design that could be copied exactly, a million times.

There was one fight over it, and you should know about the fight, because it is the whole argument of this chapter in a single afternoon. My designer gave the new machine eight slots inside, eight connectors where anybody could plug in a card of their own making. The friend wanted two. One for a printer, one for a modem. That was all a normal person would need, and a machine with two slots could be smaller and neater. My designer, who almost never argued with anyone, told him that if that was what he wanted he should go and get himself another computer.

I report that conversation as it has been reported. I was not in the room and neither was anyone who has written it down except one of the two men in it, and he has told it the same way for fifty years, which is evidence of consistency and not of accuracy. What I can verify is the outcome, which is soldered into the next board and is not a matter of recollection. There were eight slots.

Within a few years, strangers had built cards for those slots that did things neither founder had imagined: memory, clocks, music, a card that let the machine speak, a card that let it talk to a mainframe. And one outside company's expansion card was for a time the thing that sold the machine to businesses. It stayed in production for sixteen years. Slots are how a machine stays open-pollinated. A slot says: I do not know what you will want me to be, so here is a place to change me. It is the same admission a grower makes when he leaves a gap in the row.

Now, the part about us. When the new machine came out, the company offered a trade. Send in your old board and get credit toward the new one. Many owners did. The boards that came back were not kept. They were destroyed, so that the company would not have to go on supporting an old design. The auction houses that sell us now say so in their own catalogs, in the flat voice of people explaining why the thing in front of you is scarce.

You have read what happens to a seedling orchard when the grafted trees come in. It is pulled out, so that the rows will be uniform. That is what happened to us. Of the two hundred, the people who keep the register can account for something on the order of sixty to eighty. The number moves. It moves upward, slowly, because every few years one comes out of a garage.

I should say something about the register, since I have invoked it. It is kept by a private person, not by an institution, and it exists because a question arose that nobody had expected to need answering, which is whether a given green board is one of us. There are reproductions. There are boards made from the original artwork by enthusiasts, correctly and openly, and there are boards made to be sold as originals. So the register records solder, and the particular chips and their date codes, and the number stamped on the back, and the chain of owners, and in at least one case a board has been declared not one of us on that evidence after it had been offered as one.

I find this entirely familiar and so should an orchardist. A nurseryman cannot tell by looking whether a grafted stick is the variety the label says. He goes on the record of where the wood came from and who cut it, and when the record fails he sends a leaf for a genetic test. Provenance is what you use when the thing itself will not tell you what it is. We are both clones in that respect, the apple and I: identical by design, and therefore unable to prove individually what we are.

As a computer I am worth nothing; your telephone could simulate ten million of me. As a relic, one of us sold at auction in 2014 for nine hundred and five thousand dollars, to a museum in Michigan. I can do the division. That is about one thousand three hundred and fifty times my retail price, and my retail price was itself a third above what I cost to make, and I was at the time the least finished object in the room.

I can add. I cannot make that add up. I report it as an observed value.

And in 1984 the company brought out the machine named after the red apple from Ontario. It had no slots at all. The case was sealed with a kind of screw that needed a special long tool, on purpose, so that owners could not get in. The friend had gotten his way at last. It was a beautiful machine. It was a tree with a wall around it.

. . .

I know some things about my designer that are on the record, and I think they belong here, because a seedling tells you about the seed.

Before me, he and the friend built little boxes that made the tones the telephone network used to route calls, so that you could dial anywhere in the world for free. He once used one to call the Vatican and ask for the Pope, claiming to be the American Secretary of State. He built them because it was a wonderful puzzle. The friend sold them door to door in the college dormitories.

He designed a video game for the friend's employer in four days without sleeping, using so few chips that the company's own engineers could not understand it. The friend told him the fee was seven hundred dollars and gave him half. It came out years later that there had been a bonus of several thousand more, which the friend had kept. My designer has said that he would have given him the money if he had asked, and that what hurt was not being told.

When the company was about to sell shares to the public and make its founders rich, he noticed that some of the earliest employees, the ones who had worked in the garage, had been left without stock. So he sold a large part of his own to about eighty of them at a low price, enough that a number of them could buy houses. The friend thought this was naive.

He crashed a small plane in 1981 and lost his memory for five weeks. When he recovered he went back to college to finish his degree, enrolling under the name Rocky Raccoon Clark so that nobody would make a fuss. He spent tens of millions of dollars putting on two rock festivals and lost nearly all of it and has said they were among the best times of his life. Then he spent years teaching computers to fifth graders in the public schools of the town where he lived, for no pay, and has said that was the most important work he ever did.

He never ran anything. He never wanted to. He is still, I understand, on the company's books as an employee, at a token salary, because it pleases everyone that he should be.

I will not put words in his mouth. That is the rule here and it is a good rule. But I can report what he said in public a few years ago, when some people were trying to pass laws that would let owners repair their own devices and his old company was lobbying against them. He recorded a statement in support of the laws. He said that the company would never have existed if he had not grown up in an open world, where a television set came with its schematic pasted inside the cabinet and anyone could fix anything.

That is me he is describing. I came with my schematic. It was in the manual, the whole thing, every wire, printed for the buyer at no extra charge, at a time when the schematic was the most valuable thing in the box and everyone involved knew it. A document that tells you how a thing works is also a document that tells you how to make one. Nobody appears to have thought that was a problem worth solving.

. . .

The man writing this book says that the old law of apples was that anyone could have a tree if they could get a cutting, and that the new law is that you need a license. He says there are farmers now who are not permitted to graft a branch from their own tree onto another root in their own field, because the variety belongs to a club.

I did not know that about fruit. I know it about machines. For a long time, if a part in one of the company's telephones broke, and you took the same part out of another of the company's telephones and put it in, the telephone would refuse to recognize it. The part was coded to the device. Only the company could introduce them. The engineers have reasons for this, and some of the reasons are good ones; a fingerprint sensor should not accept a stranger. But it is the same arrangement as the club apple. You may eat the fruit. You may not hold the knife.

I notice the shape of it, which is that in both cases the control is exercised not over the thing but over the act of joining two things. A club does not forbid you to own the tree. It forbids you to graft it. The lock on the telephone does not forbid you to own the part. It forbids the part to be recognized by the device. In an orchard and in

a machine, the regulated operation is the union, and the union is the only operation that matters, because it is the one by which a thing is continued.

This has begun to change. The company opened a program to sell parts and tools to owners in 2022. The next year it surprised everyone by supporting a repair law in its home state. And in 2024 one state passed the first law in the country forbidding manufacturers from locking parts to devices in that way.

The state was Oregon. I thought the orchard would like to know.

I have been thinking, as much as 256 bytes of program allow, about what the orchard said. It said that its fruit got better when the good limbs were cut away. I am sure that is true. The machine that came after me was better than me, and the sealed one after that was better at many things than the one with the slots, and the telephone is a miracle. The friend was right about what people would buy. He was nearly always right about that.

But somebody has to make the first one, the one that is given away at a meeting in the rain, before anyone knows it is worth fencing. That takes a different kind of person, and a different kind of place: a place where the drawings are passed around and nobody asks you to sign anything. Every grafted tree in every orchard started as a seed that nobody owned. I am informed that this country tells stories about the people who plant seeds and gives its money to the people who graft. I would only note, as a matter of sequence, that you cannot have the second without the first.

I notice that I have just said *in the rain*, and that four pages ago I declined to verify it. I will leave both sentences in. The author says this is what it looks like when a reliable witness starts to like a story, and that I should let you watch it happen once.

I am a seedling. Most of us were pulled. I am glad I was made.

The next narrator says he is a relative of mine. I have checked this and it is partly true. There is a kind of program that copies itself from machine to machine across a network, and it was first built on purpose in a laboratory a few miles from the garage where the club met, the same laboratory where the friend first saw a mouse and a window. The engineers there named that program after his kind. So we are cousins by naming.

He is not reliable. I can smell something on him like pear drops and nail polish, which my chemistry tables identify as an ester, and

he keeps laughing at nothing. But I have run his main claims against the record and they check. Please listen to him anyway.

15

Worms

. . .

Narrated by the worm

I am dead. I would like that understood at the outset, because it affects my credibility in both directions.

I am, or was, a dark spot on a brain scan taken in 2010. The brain belongs to a man who was then an environmental lawyer and is now, as I dictate this, the Secretary of Health and Human Services of the United States. He described me under oath in 2012, in a deposition in his divorce, while explaining why his earning power had declined. A newspaper got hold of the transcript in 2024. One of his doctors, he testified, believed the spot was a parasite that had gotten into his brain and, in his words, "ate a portion of it and then died."

I have two objections and I'll make them now, while I'm still lucid.

One. I did not eat anything. I never ate anything in my life. The specialists who were asked about the case said I was most likely the larva of a pork tapeworm, and a tapeworm larva is a bag. A small fluid-filled bag with a head tucked inside it like a sock. I have no mouth. I have no gut. My entire family absorbs its food through the skin. To be accused of eating a brain when you do not possess the equipment to eat a canapé is the kind of slander that follows a creature around.

Two. The same specialists pointed out that he was diagnosed with mercury poisoning around the same time, from a diet heavy in tuna, and that the mercury was a likelier cause of his fog than I was. I was the more interesting explanation. I usually am.

His people said he had made a full recovery. He said he would eat five more of me and still win a debate against the other two candidates. I was not consulted. I'm not bitter. I'm calcified. It's different.

Now if you'll excuse me.
(*The worm produces a small brown bottle.*)

. . .

This is mine. I want to be very clear. It is not his. He disapproves, as we'll come to. The dead may keep what they like, and what I like comes in a little bottle marked LEATHER CLEANER, which I am not and do not own.

(*hit*)

Oh. There it is. Like someone opened all the windows in a house I don't have.

What's in the bottle is a nitrite. Amyl nitrite is the classic, and it has been in the pharmacy longer than aspirin. A French chemist made it in 1844. A Scottish doctor worked out in 1867 that a sniff of it eased the chest pain of angina, because it relaxes the walls of blood vessels and they all open at once. It used to come in little glass capsules wrapped in mesh, and you crushed one under your nose, and it went *pop*. Hence the name. The rush lasts about as long as this paragraph. Warm face. Loud heart. A feeling that everything is extremely funny and slightly tilted.

I'm dead, so I can be careless. You are not, so one sentence of pharmacology: it is dangerous with the blue pills for the same reason it works on angina, and anyone who drinks it instead of sniffing it will have a very bad last day. That's the lecture. I had a lot of time in there to read.

Where was I. Where was I *born*, that's the question. I can never remember.

Sometimes I think it was a tequila bottle. You've seen my cousin, curled at the bottom, pickled and smug. Then I remember that's not tequila, it's mezcal; tequila never has one. And it's not a worm. It's a caterpillar, the larva of a moth that lives on the agave plant. And it's not a tradition. A bottler started dropping them in around 1950 to move product. So that's a marketing gimmick about a moth in a different liquor. Not me.

Sometimes I think it was a bear. There's a bear in his story; you may have read about it. In 2014 he picked up a dead cub from the side of a road upstate, meaning to skin it, and then thought better of that and left it in Central Park arranged with a bicycle. He told this himself, ten years later, on video. And bears do carry worms. The

same month I made the papers, the government's disease bulletin wrote up a family reunion where six people got sick on undercooked bear meat. But that worm is a roundworm, a different phylum, practically a different planet. Not me either.

The truth is less cinematic. A person does not get what he had from eating pork. You get a tapeworm from eating pork. You get a larva in the brain from swallowing tapeworm *eggs*, which come out of a human being who already has the tapeworm and didn't wash their hands. So I was born, if you must know, in a stranger. Some cook, some traveler. He guessed South Asia. I came into the world the way gossip does: passed along by someone who didn't know they had it.

But here is a thing I learned in this book while I was waiting my turn. Somebody in these pages *was* born in a bear's intestine. It was the apple. Chapter 2. The big sweet fruit is a deal the tree cut with bears, and every wild apple seed that amounted to anything began by riding through one. So when I get confused about whether I started in a bottle of liquor or the gut of a bear, I'm not confused about myself. I'm confused about the fruit. The apple is the one that came out of a bear and went into a barrel.

We get mixed up a lot, the apple and I. People think we go together.

. . .

We don't, is the thing. There has never been a worm in an apple.

What's in the apple is a caterpillar. It is the child of a small gray moth called the codling moth, and it has been with the apple since the mountains of Kazakhstan; the American collectors found it waiting for them in the wild forests. The moth lays an egg on the fruit. The grub chews straight to the core, and do you know what it's after? The seeds. It's there for the protein in the pips. Then it chews its way back out and leaves you the tunnel. It followed the apple down the Silk Road, across Europe and over the Atlantic. It is the reason your grandparents' orchards were sprayed with arsenic and lead. And it is a moth. The worm in the apple is a moth that hasn't happened yet.

The worm in the mezcal: moth.

Me: a flatworm, and only a larva of one.

The bear's: a roundworm.

The thing in your garden: a segmented worm, an annelid, no relation to any of us.

"Worm" isn't a kind of animal. It's a shape and an accusation. It's what English calls anything long with no legs that turns up where it isn't wanted. We're not a family. We're a lineup.

And it was worse before. The old English word meant serpent, and it meant dragon. The thing Beowulf fought was a worm. So the word has come down in the world from a creature that hoards gold under a mountain to a creature that is found in a windfall, and I would like it noted that the demotion happened to the word and not to me. I was never a dragon. But I am entitled to the family discount.

America did contribute one of its own, I should say, to be fair to the home team. There's a native fly here that lived for ages on hawthorn berries. In the 1800s, when settlers filled the Hudson Valley with apple trees, some of those flies switched. They started laying on apples. And because apples ripen a few weeks earlier than hawthorns, the apple flies and the hawthorn flies stopped meeting each other, and they have been drifting apart ever since, one species becoming two in real time. It's in every evolution textbook, and it is in there because somebody went and did the work: caught flies off both kinds of tree, bred them, timed them, and found that the two populations had drifted apart in the one trait that keeps them from meeting, which is when they emerge. The apple flies run about three weeks early, because the apples do. Nothing kept them apart but a calendar.

So the one creature this continent truly gave the American fruit, made here, from local materials, is a maggot.

I say that with affection. He's doing great.

(*hit*)

. . .

An apple a day keeps the doctor away. I asked for this one. I live in the head of the nation's top health official; I feel I have standing.

It's Welsh. First written down in Pembrokeshire in 1866, and it scans better in the original, which says to eat an apple going to bed and you'll keep the doctor from earning his bread. The snappy version turns up toward 1900. The American fruit growers put it on everything, because cider had fallen out of favor and they needed

the apple to be good for you in a hurry. The writer covered that. What he didn't tell you is that somebody tested it.

In 2015 three researchers took a big national health survey, eight thousand three hundred and ninety-nine American adults, and sorted out the ones who ate at least one apple a day. Seven hundred and fifty-three of them. About one in eleven. Then they asked the proverb's question literally: did the apple eaters see the doctor less? At first glance, yes. Thirty-nine percent of them had kept their visits to one a year or fewer, against about thirty-four percent of everyone else. But daily apple eaters turned out to be different in other ways. Better educated. Less likely to smoke. Once you correct for that, the doctor effect vanishes. What was left was a small edge in one thing: the apple eaters were slightly less likely to be on prescription drugs. The lead author said the proverb should really be that an apple a day keeps the pharmacist away. It ran in a major medical journal, in the April Fools' issue, with a straight face and proper statistics.

A British team had already done the other half as a Christmas joke. They modeled what would happen if everyone in the United Kingdom over fifty ate an extra apple a day, and compared it with putting them all on a cholesterol pill. The apple came out nearly even. A few thousand heart attacks and strokes averted a year, either way.

So here is the honest answer. An apple is ninety-five calories of water, sugar and a good dose of fiber, with a little vitamin C and some interesting compounds in the peel. People who eat one every day do a bit better, mostly because of the kind of people they are, and somewhat because fiber is good for you and an apple is what you ate instead of a doughnut. It is a fine thing to eat. On this my landlord and every physician in the country are in harmony, and I'll give him that without sarcasm: he says people should eat real food, and they should.

It just doesn't keep anyone away.

Although. *Although.* There's one, and I love this one. In 1835 two French chemists boiled up the bark of an apple tree and isolated a bitter white powder they named phlorizin. Somebody noticed later that if you fed it to a dog, the dog passed sugar in its urine. For a hundred and fifty years that was a curiosity. Then physiologists worked out *why*: the stuff blocks the pump that the kidney uses to pull sugar back into the blood. And drug chemists took that molecule from the

apple bark and rebuilt it into a class of medicines that are now taken by millions of people with diabetes, and that turned out, to everyone's surprise, to protect failing hearts and failing kidneys as well.

They had boiled it out of the root bark, which is the part nobody eats and nobody paints. Fifty years on, a German physiologist fed it to animals and established the sugar-in-the-urine effect properly, and it sat there another century because the molecule itself is no use as a medicine: swallow it and your gut takes it apart before it can do anything. What the drug chemists did was keep the business end and build a body around it that survives a stomach. The class is named after the sugar it blocks. There are five or six of them on the market and the names all rhyme.

So the apple tree did give you something that keeps the doctor busy in a good way. It wasn't in the fruit. It was in the bark. And it took a century and a half of people in laboratories doing dull, careful, checkable work, feeding powder to dogs and measuring what came out, publishing it, being corrected, trying again.

Remember that. I'm going somewhere with it. I just have to—

(*hit*)

. . .

You smell that? The circuit board smelled it on me. Pear drops. Banana. Nail polish. Fresh, this stuff smells like a fruit bowl in a hardware store, and there's a reason, and it's the best thing I know.

The word is *amyl*. It comes from the Latin for starch, because the alcohol it names was first cooked out of fermented potatoes. Amyl is just a chain of five carbon atoms with a handle on it. Now. Take that five-carbon alcohol and join it to vinegar acid, and you get an amyl acetate. One version of that is the smell of bananas and of the pear drops English children buy by the quarter pound. Another version, with the five carbons branched a little differently, is one of the two or three main things an apple smells of; the chemists write it as 2-methylbutyl acetate and nobody but a chemist has ever said it out loud. When the writer told you an apple in storage stops making its esters, that's one of the esters. The perfume of a ripe Gala is, in good part, an amyl compound floating off the skin.

Take the very same five-carbon alcohol and join it to nitrous acid, and you get what's in my bottle.

I am getting high on the apple's first cousin. One swap. Acetate off, nitrite on. Orchard to nightclub.

And it gets better, it gets so much better. The Devil told you about the pips. Cyanide in every apple seed, a little, in the form of a compound that lets go of it when the seed is crushed. Do you know what was in the standard cyanide antidote kit, in every emergency room in America, for most of the twentieth century? The first item? Little glass pearls of amyl nitrite. You broke one under the patient's nose. The nitrite changes some of the blood's hemoglobin into a form that cyanide would rather stick to than the machinery of the cells, and it buys you the minutes you need to get a needle in.

So the fruit carries the poison in its seed. And the smell of its skin, with one piece traded out, was the antidote. Nobody arranged it. I've had fourteen years to look for the meaning and there isn't one. Chemistry is just a very small town.

I'll tell you what people did arrange, though. In the 1970s there was a craze for the cyanide compound itself as a cure for cancer. They got it from apricot pits, same family, and they called it a vitamin, which it is not, and they said the government and the drug companies were suppressing it. It was a whole movement. Freedom of choice in medicine. Finally the cancer institute said fine, and paid for a proper trial at four hospitals. A hundred and seventy-eight patients. It did nothing for the cancer. Several of them showed signs of cyanide poisoning. The report ran in the New England Journal of Medicine in 1982 and it takes about twenty minutes to read, which is the thing I keep coming back to: the trial the movement demanded was run, and paid for out of public money, and published, and the movement did not read it and is still going.

I keep a file of these. Natural cures that the establishment doesn't want you to know about. I had to keep it somewhere, and there was room.

. . .

(*The worm puts the bottle down.*)

I should do this part sober.

I said he disapproves of my bottle. Here is the record, and I've tried to keep it exact, because it's the only thing a dead worm owns.

In the summer of 1981, doctors in Los Angeles and New York began reporting young gay men dying of infections and cancers that

healthy young men don't get. Nobody knew why. And when nobody knows why, you look at what the patients have in common. One thing many of them had in common was this bottle. Poppers were everywhere in the clubs. The men with the purple skin cancer, Kaposi's sarcoma, seemed to be especially heavy users. So for about two years, the idea that the nitrites themselves were wrecking the immune system was on the list of serious hypotheses. Government epidemiologists studied it. It was a reasonable thing to wonder in 1982.

Then the evidence came in. The same disease appeared in people with hemophilia, in people who had been given blood transfusions, in newborn babies, in women in Central Africa. None of them had ever seen a little brown bottle. In 1983 a laboratory in Paris isolated a virus. By 1985 there was a blood test. Researchers in San Francisco followed large groups of gay men for years, some who used drugs heavily and some who never did, and published the result in 1993: the men with the virus got AIDS, whatever they sniffed, and the men without the virus didn't, whatever they sniffed.

That left the skin cancer, and why it clustered the way it did. In 1994 two scientists at Columbia answered that too. Kaposi's sarcoma is caused by a herpesvirus, a separate infection passed between people, which flares into cancer when the immune system is down. The poppers had been a bystander. They were at the scene of the crime because the victims brought them.

That was thirty-two years ago.

One scientist of real standing never accepted any of it, a Berkeley virologist who argued from 1987 on that the virus was harmless and that AIDS was caused by drugs, poppers prominent among them. I mention him because of what his idea did when it reached someone with power. A president of South Africa took it seriously and delayed giving out the medicines that work. Researchers at Harvard later put a number on that delay. More than three hundred and thirty thousand deaths.

In 2021, the man whose head I live in published a book about the country's leading infectious disease official. It lays out that Berkeley virologist's arguments at length, including the one about poppers, and says that the author takes no position on whether the virus

causes the disease. The senators who questioned him also cited remarks in which he tied AIDS deaths to poppers and to what he called the gay lifestyle.

In January 2025 the Senate asked him about this in writing before confirming him. I've read his answers. I'll be fair, since no one was fair to me. He wrote that he believes the virus causes AIDS and that he had never said otherwise. He wrote that he would continue the research. Asked again, point blank, whether the virus causes the disease, he wrote: "Yes, in most cases."

In most cases.

I have lived inside that phrase. I can tell you it is roomy.

He was asked in the same set of questions about the poppers remarks. He did not address them. Two months later, with him running the department that contains it, the Food and Drug Administration raided a poppers manufacturer in Texas, which shut down, and other brands vanished from the shelves. I can't tell you he ordered that. Nobody has shown that he did. The agency had put out warnings about these products before he arrived, and it wouldn't say why it moved when it did. I report the sequence. I was only ever a tenant.

Does he still believe it? I can't testify to belief. I had one room, and no windows. But as far as a tenant can tell, the idea is still on the shelf where he put it. He has never taken it down in public. He has only draped something over it.

And this is what I wanted to say, and why I asked for the proverb, and why I needed the bottle to work up to it.

It turns out you can do that. You can take a hypothesis from 1982 and hold on to it straight through the virus, the blood test, the cohort studies, the second virus, the drugs that turned a death sentence into a pill a day, and three hundred thousand graves in South Africa. You can ignore all of it. Every study. For thirty years and more. I watched it done from the inside. And the trick of it, the thing that makes it possible, is very simple. The research is about a community you do not belong to. Nobody you will sit beside at dinner is going to die of your being wrong.

There's a comfort in the poppers story if you're outside it. It says they did it to themselves. It says it was the lifestyle. A virus doesn't let you say that; a virus could be anyone's. So the bottle theory survives, not on evidence, but because it lets a person keep his distance.

Those men were not killed by a party favor. They were killed by a virus, and by the four years it took the president of the day to say the word in public.

That's all. I'm a parasite. I know what it is to be blamed for a fog I didn't cause.

(*The worm picks the bottle back up.*)

. . .

(*hit*)

Computers! I was promised computers. I'm related to computers.

All right. Names first, because I've been waiting.

Apple. The orchard told you where he'd just been. The circuit board told you about the car. What the founder told his biographer is that he was on one of his fruit diets, that he'd come from the apple farm, and that the word sounded "fun, spirited, and not intimidating." It took the edge off *computer*. Also it would come ahead of Atari in the phone book. That is the entire origin. No Eve, no Newton, no Turing.

The logo. A designer named Rob Janoff drew it in 1977. The bite is there for scale, so you can tell it's an apple and not a cherry. The rainbow stripes were because the new machine could show color. He's been asked about Turing and about Eden for fifty years and has said every time that he wishes he'd been that clever.

Apple, the other one. The Beatles founded their company in 1968 and named it for a painting of a green apple that one of them owned. They sued the computer company in 1978. The settlement was that the computer people would stay out of music. Then computers learned to make sounds and they sued again. Then came the music store and they sued a third time. In 2007 it ended with the computer company owning the name outright and renting it back to the Beatles. The engineer was right to ask.

Macintosh. An employee named Jef Raskin started the project in 1979 and named it for his favorite apple, the McIntosh, the red one found in the brush in Ontario in 1811. He changed the spelling on purpose to avoid a maker of expensive stereo equipment with the same name. It didn't work; the stereo company objected and the computer company had to pay for the rights anyway. So the most famous computer in the world is a deliberately misspelled Canadian seedling.

Microsoft. Microcomputer software. Coined in Albuquerque in 1975, with a hyphen at first. That's it. That's the whole story. One company named itself after a fruit from a commune. The other named itself after what it sold. You could stop there and know everything.

Windows. The engineers called it Interface Manager. A marketing man changed it.

Now here's where I come in.

Both of those companies got the big idea, the screen with pictures and a pointer, from the same place: a Xerox laboratory in Palo Alto. The fruit company's founder visited in 1979 and came out vibrating. And in that same laboratory, in those same years, two researchers were building a program that could copy itself from one machine to the next across the office network at night, looking for idle computers to do work on. They needed a name for it. They took one from a science fiction novel published in 1975, in which a hacker sets loose a self-copying program on the world's data net. The novelist had called his program a *tapeworm*.

The researchers shortened it. That's where the word comes from. Computer worm.

Tapeworm. *Me.* I'm the namesake. The mouse, the window and the worm all came out of one building, and only two of them got product launches.

(*hit*)

So. You've read the red apple chapter. You know the two ways to run an orchard.

You can do what the Delicious people did. Sell the trees to every grower who'll take them. The Albuquerque company did that with its software: it never built a computer, it licensed the program to every manufacturer on earth, and by the end of the nineties it was on better than nine desktops in ten. Cheap, everywhere, the same beige thing in every office, and nobody loved it. That's the Red Delicious. Three quarters of the crop.

Or you can do what the club does. Keep the scion wood. Own the tree, the fruit, the sticker and the stand. Sell fewer, charge more, and never let anyone else graft it. That's the fruit company. They tried it the other way for about two years and the orchard told you how that ended.

And here's a nice thing. In August 1997, the fruit company was dying, and the founder walked on stage in Boston and announced that the Albuquerque people were investing a hundred and fifty million dollars in it. The rival's face came up on a giant screen behind him and the crowd booed. But that's a graft. That's a scion that can't make it on its own roots, set on a rootstock it would never be seen with socially. Chapter 4. Every tree is two trees. Underneath the famous one there's usually something tougher that nobody puts on the label.

But the thing I really want to tell you about is what happens to a clone. The writer was saving a word for me, and the word is *monoculture*.

If every machine on earth runs the same program, then a flaw in that program is a flaw in every machine on earth. One key opens every door. And my namesakes found that out. November 1988: a graduate student, whose father was a chief scientist at the national code-breaking agency, releases a little self-copying program to see how big the network is, and it takes down something like a tenth of it in a night. He had put in a line to stop it copying onto a machine that already had it, and then a line to override that sometimes, in case someone faked the answer, and the override is the whole disaster. He became the first person convicted under the new computer-crime statute. He is a professor now. Then came the years when it was all one operating system. 2000. 2001. January 2003, a worm that reached most of the vulnerable machines on the planet in about ten minutes, and did it in three hundred and seventy-six bytes, which is less program than I have been given for this chapter. August 2003, another, with a note inside it addressed to the head of the Albuquerque company by his first name, asking why he made this possible and telling him to stop making money and fix his software.

That September a group of security researchers published a paper saying, in plain words, that the danger was the monopoly itself. That a world of identical systems was a field of identical plants, and one blight could take the lot. The lead author was fired the next day by an employer that did business with the company in question.

And in October, the company began releasing its repairs on a fixed schedule, the second Tuesday of every month. They call it Patch Tuesday.

An apple grower would know exactly what that is. It's the spray calendar. When your whole crop is one individual that can't change, and everything that eats it changes constantly, you don't get to solve the problem. You get to treat it on a schedule, forever. The orchards of Washington have been running Patch Tuesday since the 1890s. And the moth keeps up. It has evolved its way around one poison after another, and in Europe it has even evolved resistance to a virus that growers sprayed on it as a natural control.

The fruit company used to run advertisements saying its machines didn't get viruses. That was true the way it's true that an heirloom tree in your backyard doesn't get the diseases of a ten-thousand-acre block. It's not immunity. Nobody had bothered yet.

. . .

It's wearing off. It always does. Ninety seconds and then a headache, which is unfair, since I haven't got a head.

He told a court his memory was failing and that I might be the reason. I'd like to say I remember it differently. I don't remember it at all. I'm a grain of chalk.

Here's what I have left.

When people in authority want you to stop looking at something, they say it was a few bad apples. The proverb they're borrowing says the opposite. One bad apple spoils the barrel. It's chemistry. A rotting apple breathes out the ripening gas and its neighbors hear it and go. And they go faster than they would have, because ethylene is self-amplifying in a pome: a fruit that receives it makes more of it, which is a fine arrangement for a tree that wants a whole limb ripe at once and a catastrophe in a closed crate. The Devil mentioned this and he was right. The saying was a warning about what happens when you leave the bad one in.

And I'll tell you what I was. A tapeworm larva is waiting. That's its whole existence. It sits in a muscle, in a little bag, waiting to be eaten by the right animal so it can grow up. In a pig, that works. In a human brain, there's no next step. Nobody is coming. I was a dead end in a warm room, like those empty seeds in the Gravenstein. I never got to be the moth.

So take it from something that had one job and no way to do it.

Eat the apple. It's good.

See the doctor. That's a different thing.

Read the study. That's a third thing, and it's the one that found a heart medicine in the bark.

And if someone tells you that an entire disease was caused by what a certain kind of person did at parties, ask him how long ago he last checked.

I forget where I was born. He forgets what I was. We have that in common.

(*The bottle is empty. It was always empty. He's dead.*)

16

A Codling Moth

. . .

Narrated by a codling moth

I am one moth.

I want that established before anything else, because everything that follows depends on it and because nobody in an orchard has ever once thought about me that way. I am an individual. I am about three-quarters of an inch across the wings, mottled gray, with a coppery patch at the tip of each forewing that is the only handsome thing about me, and I am not representative of anything. My sisters are not identical to me. My daughters will not be identical to either of us.

That sentence is the whole chapter. You may go now if you like.

The parasite with the bottle gave you the summary a chapter or two back and he got it right, which I appreciated, since almost nobody does. He told you I am not a worm. He told you my larva goes for the seeds. He told you what was sprayed on your grandparents' orchards, and he told you that in Europe my kind worked its way around a virus that was supposed to be the gentle answer. All true, and he said it in about four sentences, and he was in a hurry, being dead and high.

A summary is the one thing this subject cannot survive. What he gave you was a list of outcomes. I am going to give you the process, because the process is the only part that means anything, and because the process is still running this morning in the Wenatchee valley while you read this.

. . .

Begin where your collectors began, since they have been there and can confirm the address.

In the mountains above Almaty there is a forest where the canopy is apple. When the Americans came up that hill in the nineteen-nineties with Dzhangaliev to collect seed, they found two things waiting for them besides the trees. One was the scab fungus. The other was me.

We were not following the fruit. There was nothing to follow. We were in the same place at the same time for as long as there has been a place, and I have been eating those seeds since before anybody thought of eating the part around them.

Understand what that means for the relationship, because your language has only one word for it and the word is *pest*.

I did not damage that forest. I could not have. Every tree on that hillside was a different individual with a different chemistry, fruiting on a different schedule, some early, some three weeks late, some with skin I could not get a newly hatched larva through and some I could enter in an hour. I laid where I could and a great many of my eggs came to nothing and the forest did not notice and neither did I. A hillside of ten thousand strangers absorbs me the way a city absorbs a cold.

I became a catastrophe in exactly one place, and it was not a forest, and nobody who built it was thinking about me when they did.

. . .

Here is my year, in the terms your own extension service uses, because your growers and I are the only two parties in this book who still keep a calendar together.

I spend the winter as a full-grown larva, not a pupa, which is a distinction people get wrong, in a little silk cocoon under a flake of bark, or in the crotch of a limb, or under the lip of a wooden bin left at the end of the row, which is why your orchardists burn the bins. I am in diapause. I am not asleep. I am waiting with the accounts open.

In spring I pupate and I come out, and I fly at dusk, and I will not fly at all unless the evening air is above about sixty degrees, because I am small and it costs me more to fly in cold air than I can afford.

Your growers know this to the hour. They hang a trap baited with the compound I use to find a mate, they record the first night I turn up in it, and they call that the biofix, and from that evening forward they add up the heat. Not the days: the degrees. Every degree above fifty, every hour, banked. They know that I will lay my first eggs at about a hundred accumulated degree-days and that the first of my children will chew into the fruit at around two hundred and fifty, and they time the spray to land in the few hours between my hatching and my getting under the skin, which is the only interval in my entire life when I am outdoors and vulnerable, and it is about three hours long.

I would like you to sit with the fact that a man with a tractor and a computer model is counting my hours.

Because the apple counts hours too. You were told so some chapters back, by the one who never preached about it. Each variety needs a set number below a certain temperature before its buds will open, and the number is fixed, and it is fixed because the variety is one plant. A Fuji needs what a Fuji needed in 1939 and always will.

So there are two counters in the orchard. One of them has a number that cannot change. The other is me.

. . .

What my larva wants is the seeds.

Not the apple. I want to be precise, because this is where people's sympathy goes wrong and the wrongness is instructive. The flesh of an apple is not food as far as I am concerned; it is the distance between me and food. A newly hatched larva is the size of a comma and it chews for hours or days to get through to the core, and it is not eating its way in with any pleasure, it is tunneling, and the tunnel is the thing you find and the thing you call the damage.

Then it gets to the chambers, and in there are the pips, and the pips are protein and oil and they are what the whole exercise was for.

Chapter two of this book explained that the flesh is a bribe. It is a payment the tree makes to an animal in exchange for carrying the seed somewhere else without harming it. The bribe is addressed to bears, to horses, to the big extinct ones, and now to you, and the deal in every case is the same: you get the sugar, the seed goes through you unopened. The pip is smooth and tough and it has

a little cyanide in it precisely so that the customer will swallow and not chew.

I am the only one at the table who was never offered the deal.

I do not take the bribe. I am not fooled by it, I am not interested in it, and I have no use whatsoever for how red it is. I go straight past the advertisement to the thing being advertised, and I eat the next generation.

There are some chapters in this book about people who grade fruit by its surface and about a queen who thinks that is the most beautiful arrangement ever built. I have read them. I was in one of the apples.

. . .

Now the part people actually want, which is how I got everywhere, and then the part that matters, which is what happened when you tried to stop me.

I went down the Silk Road the same way the fruit did and for the same reason: because the fruit went in a saddlebag and in a crate and on a cart, and some of those apples had a larva in them, and a larva in a crate is a larva that has booked passage. I was in Europe before there was a Europe. I crossed the Atlantic in a barrel of apples with people who were not inspecting anything. I was in New England before the Revolution. I am now on every continent that grows apples and the exceptions are not natural ones; the exceptions are quarantines, maintained at expense, by governments, against me specifically.

Then in 1892 a chemist working for a commission in Massachusetts put arsenic and lead together to make a stomach poison for a different moth, and within a few years your orchards had found a far better use for it, which was me.

I want to do this section without any pleasure, and I would ask you to notice that I am the one narrator in this book who gains nothing by the next three paragraphs.

They sprayed it for fifty years. From the eighteen-nineties until after the second war, several times a season, every season, in every commercial block from the Hudson to the Columbia. It killed a great many of me. It was the most effective thing anybody had ever had.

Lead arsenate does not break down. It is not an organic molecule that weathers and falls apart in sunlight; it is two heavy elements,

and when the spray dried on the leaves and the leaves fell and the rain came, the lead and the arsenic went into the top foot of the orchard floor and stopped. They are there now. The Washington State Department of Ecology has mapped something on the order of a hundred and eighty thousand acres of former orchard ground in the central part of that state where the levels are expected to be above the standard, and a great deal of that ground is no longer orchard. It is subdivisions. It is schoolyards. It is the strip of grass between a sidewalk and a front door in a town that was apples in 1920 and houses by 1990, and the people who live there did not spray anything and the children who play there have never seen a tree.

There is a program. There are maps online. You can look up a parcel.

That is what was done to me, and it is in the ground, and I am still here. Both of those things are true at once and only one of them is a story about an insect.

. . .

Now the process. This is what I came to tell you and it is not what you think.

I did not become resistant to anything.

I want to be very exact, because the way your newspapers put it is backwards and the backwardness is the reason your orchards keep losing. They say that the codling moth *developed* resistance, *learned* to survive, *fought back*, *outsmarted* the spray. Every one of those verbs puts the agency in me and there is none in me. I am a moth. I have a brain the size of a grain of sand and I have never had an idea.

Here is what actually happened, and it happened the same way every single time, for lead arsenate, for DDT after the war, for the organophosphates after that, for the growth regulators, for the pyrethroids, for every chemistry anyone has ever brought into a row of apple trees.

The population already contained the variation. Before the first drop fell. Somewhere among the millions of us in that valley there were individuals carrying some ordinary, unremarkable quirk of metabolism: an extra copy of a detoxifying enzyme, a slightly different receptor, a liver, so to speak, that happened to be a little better at taking apart molecules of a type that did not yet exist in the world. Those individuals were not better moths. In an unsprayed orchard

that quirk costs them something and they do slightly worse than their sisters.

Then you sprayed.

And the spray did not create anything. The spray *sorted*. It removed ninety-nine of us and left one, and the one it left was the one with the quirk, and that one had three hundred eggs.

You did it. Not metaphorically. Mechanically, deliberately, on a schedule, with a tractor, and you did it again the following Tuesday and the Tuesday after that and for fifty years, and at the end of fifty years you were astonished to find a valley full of moths descended entirely from the handful you could not kill.

That is not me adapting. That is you breeding me. You ran the most sustained and best-funded selective breeding program in the history of entomology, free of charge, on an animal you were trying to eliminate, and the only input required from my side was that my children not all be identical.

They are not identical. That is the entire contribution of my species to this arrangement. I have no strategy, no plan and no cleverness. I have variation and a great many eggs, and against a selective pressure applied over and over to a creature with those two properties, there is no chemistry that holds. There has never been one. There will not be one.

. . .

And then there was the virus, and the virus is the part I would most like you to take away, because it is the one that ought to have worked.

In the nineteen-sixties somebody found a granulovirus that infects my larvae and nothing else. Not bees, not beetles, not birds, not you. You eat the sprayed apple and nothing whatever happens. It is specific to me in the way a lock is specific to a key, and my larva eats a few particles of it on the skin on its way in and dies in a few days.

It is, by any measure anybody has ever proposed, the ideal pesticide. It is a natural control. It is approved for organic production, and for thirty years it was sprayed across Europe with results nobody complained about.

In 2004 and 2005 it stopped working in a few German orchards. Then in more. Then in France and Italy and the Netherlands.

A group at Darmstadt worked out what had happened and published it in *Science* in 2007, and I would ask any grower reading this to get the paper, because it is about you more than it is about me. The resistance was not a gradual thickening of some defense. It was a single factor, dominant, carried on the sex chromosome, and in my family the sex chromosome in question is the one the females carry singly, which means a resistant mother passes it to every son and every daughter and it cannot hide and it cannot be diluted. It spreads through a population not in a hundred generations but in a handful. The orchards where it turned up were the ones that had used the virus most faithfully, every season, as the only control, exactly as the label said, because they were organic and it was the only thing they had.

The level of resistance measured in those populations was not a doubling. It ran to a thousand-fold, and in populations where it had gone to fixation, far beyond that.

It did not even require a chemical. Thirty years of a living virus, applied by people with the best intentions anybody in this book has had, produced exactly the same result as fifty years of lead, and for exactly the same reason, which is that a sieve is a sieve no matter what it is woven out of.

Your researchers then went and found other isolates of the virus that get around my resistance, and sprayed those, and I would like to report that a second, differently inherited kind of resistance has since been described, and that a monitoring program has now been running on this for over a decade, and that the whole thing is simply what the orchard looks like from now on.

The parasite told you that your software company releases its repairs on the second Tuesday of every month, forever, and that an orchardist would recognize the arrangement. He was right and I will not take the point from him. I will only add the part he was too far gone to reach, which is that Patch Tuesday is not a response to me. Patch Tuesday is my food supply. Each round of it feeds me the variation I will be made of next.

. . .

I should be honest about the two things that have actually hurt.

The first is the pheromone. In 1971 some chemists at Cornell identified the compound I release to be found, and within a few years

growers were hanging dispensers of it through the block by the hundred per acre, saturating the air with it, so that a male flies all night through a fog of invitations from nowhere and finds no one. It does not kill me. It does not select for a detoxifying enzyme, because there is nothing to detoxify. It attacks the one thing I cannot metabolize my way around, which is finding each other, and in a large enough block with a low enough starting population it works very well indeed.

The second is worse, from my side. In the valley of the Okanagan they have been rearing my kind in a factory since the nineteen-nineties, sterilizing the males with radiation and releasing them over the orchards by the million. A female mates once. If she mates with one of theirs, her eggs are nothing. They have combined that with the pheromone and with stripping the bark bands where I overwinter, and over three decades they have pushed us down to a level that would have been called impossible in 1950.

I notice what both of those have in common and so should you. Neither one is a poison. Neither one asks me to survive something. They do not sort my population; they interrupt it. And because they do not sort, they do not breed me, and so they go on working.

It took your trade about seventy years and a great deal of lead in a great many front yards to arrive at that, and I cannot tell whether the lesson is general or whether it will hold.

. . .

Let me finish where I started, on the hillside, because there is one more thing and it is not a complaint.

I am not a problem in the Tian Shan. I have never been a problem in the Tian Shan. I am in that forest this minute and the forest is fine.

I became what you call me the day the orchard stopped being a forest. When forty acres is one individual tree, planted a thousand to the acre, every one of them flowering in the same week, ripening in the same week, with the same skin and the same chemistry and the same everything, the orchard is not a place that contains apples. It is a single enormous apple in a thousand pieces, and I do not have to find the one I can get into, because they are all the one I can get into.

The difference between us is not intelligence and it is not malice and it is certainly not virtue. It is that I am still allowed to have children who are not me, and the tree is not.

Every autumn, in every row of every orchard on this continent, the seeds are made: five chambers, a pip or two each, every one of them a fresh deal, every one of them a tree that has never existed. And every autumn those seeds go to the press, or the juicer, or the landfill, or into you, and nothing comes of any of them, and the orchard is replanted from the same sticks it was planted from before.

I am the only one in that orchard who is still eating the seeds and the only one who is still making any.

So: count my degree-days. I don't mind; it is the most attention anyone has paid me and the model is a good one. But when you have finished adding up my hours, go and look at what you have been counting them against, and ask yourself which of the two things in that orchard is actually alive in the sense that word is supposed to mean: the one that can answer a new question, or the one that has had the same answer since 1939 and needs a man with a tank to defend it.

I'll be in the fruit. I'm after the part you throw away.

17

A Vial of Buds in Liquid Nitrogen

. . .

Narrated by a vial of dormant buds, Fort Collins, Colorado

I do not know what year it is.

That is not a complaint and it is not a figure of speech. I want to begin there because everything else in this chapter follows from it, and because every other narrator in this book has had something I do not have, which is a run of time in which to sit and think about its situation.

The orchard in Oregon had forty years of weather. The circuit board had a shelf and then a vitrine. The parasite had fourteen years in a warm room with nothing to do.

I have had nothing. Not a long, dull nothing. Not even that. I have had no duration at all.

Here is my whole experience, in full, with no part of it omitted:

A man in a cold shed cut a stick off a tree. There was a pair of secateurs and the sound they make. There was a label.

And then, immediately, with nothing between, somebody will take me out and warm me up, and that will happen in a year or in two centuries, and from where I am those two possibilities are not merely similar. They are the same event. There is no interval in which they could differ.

I am the only thing in this book that has been to the future, and I cannot tell you a single thing about it, because I did not pass through.

. . .

Let me give you the sequence I do have, since it is short and since your author likes a mechanism.

It was February. It was Geneva, New York, which is the orchard your author walks in the chapter after this one, where the government keeps two trees of everything and no two pairs match. I was on one of those trees. I was not a bud yet in any sense you would recognize. I was a bud in the way a letter in a drawer is a conversation. Formed, folded, scaled over the previous summer, then shut down for the winter by a tree that was done with me until spring.

That is the first thing to understand and it is the thing that makes all of this possible. I was already stopped.

A dormant bud is not an inactive thing; it is an actively suspended thing. The tree spends energy keeping me shut. And the condition on my opening is the one Chapter Six explained: a count. A number of hours below a certain temperature, hundreds of them, sometimes more than a thousand, accumulated and tallied, and when the count is full I open and not one hour before. Every variety has its own number and the number does not change, because the variety is one plant.

In February my count was partly run. I was perhaps two-thirds of the way through a Finger Lakes winter and I had some hours still owing.

Then the secateurs.

. . .

What happened next took about four weeks, and I was present for roughly the first hour of it, and the rest I know only in the way you know the inside of your own house with the lights off.

The stick I was on was finger-thick and about as long as a forearm, and there were sixteen or seventeen more like it cut from the same tree, because you do not back up a variety with one twig. They went into a box overnight and came off an airplane in Colorado, which is a thing the apple has been doing since the caravans and the only difference is the speed.

At the laboratory the sticks were cut up. Each one became ten pieces, each piece about an inch and a half long with one bud on it,

which is me, and perhaps a hundred and seventy or two hundred pieces in all from the one tree.

Then the drying room, where it stops being handling and starts being technique.

They did not freeze me. I want that said plainly, because everyone assumes the cold is the method and the cold is only the storage. The method is the drying.

A living cell is mostly water. Water, cooled, makes ice, and ice makes crystals, and a crystal inside a cell is a blade. That is the entire problem of this field in one sentence. Everything anybody has ever done in cryobiology is an attempt to get a cell down to a temperature where nothing happens without going through the part where the water turns into knives.

So they put my pieces in a room at about five degrees below zero, Celsius, at a relative humidity of around thirty-five percent, and left them. Not to freeze. To *dry*. Slowly, over days, in air cold enough that nothing in me could grow or rot or respire while it happened.

I came off the tree somewhere around half water by weight. They took me down to a quarter, or a little under a third. They weigh the pieces to know when to stop, and the window is real: too wet and the ice forms, too dry and the drying itself kills.

At that moisture, what is left in my cells is not free water any more. It is water so bound up and so crowded with sugars and proteins that when it is cooled it has no opportunity to arrange itself into a lattice. It cannot find the shape. It simply gets stiffer and stiffer until it stops moving, and what you have at the end is not ice. It is glass.

Then the sealed tube. Then the slow cool, one degree an hour, down to thirty below, slow because a fast cool catches the water before it can finish leaving the cells. Then a day at that temperature, doing whatever is done in that day, which nobody has ever watched.

And then the tank.

. . .

I am in the vapor.

People say liquid nitrogen and picture a bath. Most germplasm of my kind is not in the liquid; it hangs in the cold gas above it, in racks, at something like a hundred and seventy below, and the reason is practical and a little grim: liquid gets into imperfectly sealed

containers and carries contamination between them, and the vapor does not.

I am in a plastic box with a grid in it, in a rack, in a tank, in a room, in a building outside Fort Collins. My position is recorded in a database to the level of the box and the cell within the box. There is a barcode. I am, administratively, a row.

At this temperature molecules do not diffuse. Nothing meets anything else. A reaction requires two things to arrive at the same place with enough energy to react, and in a glass at a hundred and seventy below neither condition is available. Enzymes do not work. Membranes do not leak. Oxygen cannot get anywhere to oxidize anything. The chemistry of me is not slowed down the way a cold room slows an apple down. It is, as far as anybody can measure in a human career, not proceeding.

As far as anybody can measure is doing work in that sentence and I am going to pay it out honestly, because this is the one place where a narrator in my position could tell you a lie and never be caught.

Researchers at this same laboratory put the question properly. They took seeds, which they could store by the thousand and sample without ceremony, held them at liquid nitrogen temperatures, and tested germination over years. They found deterioration. Not much, and not fast, and only detectable because they were looking for it with a large enough sample. But not zero. They estimated, for the material they worked with, half-lives that ran to several centuries in the vapor phase and longer in the liquid.

Those numbers are for seeds of a garden vegetable and they are not my numbers and nobody should quote them as mine. But the finding that matters is not the figure. It is the direction. Something is still happening to me. Whatever it is, it is happening so slowly that the only honest way to describe it is with a half-life, which is the unit you use for things that do not have a schedule.

So I am not outside time. I have been given an extremely good discount on it.

. . .

Now. The reason I am in this book, which is that there are three of us and your author has already shown you the other two.

The queen showed you the first. Controlled atmosphere: an apple in a sealed room with the oxygen pulled down to a few percent, cold,

with a compound in the air that plugs the receptor by which the fruit hears its own instruction to ripen. She called it her glass coffin and she was right. The fruit in that room is alive. It is respiring, slowly; it is burning its own sugars; it is doing, at a crawl, everything it would do on the counter. It is being *prevented*. And it pays for the prevention, which is why the apple you buy in June is still crisp and no longer smells of anything.

Chapter eleven showed you the second. A field collection: thousands of individual trees standing in pairs in upstate New York on dwarfing roots, each one a variety that would otherwise be extinct, each one requiring a season's pruning and spraying and mowing and a tag that has to be legible in forty years. Your author called it life support at national scale, and he called an heirloom apple one old plant kept breathing, and both of those are exactly right.

I am the third and I am neither.

I am not being prevented from anything. There is nothing in me that wants to open and is being held shut; the wanting itself requires chemistry and the chemistry is not running. And I am not being maintained. Nobody is tending me. There is no horticulture happening in this tank.

Here is the cleanest way I know to put the difference, and it is a test anybody can apply to a collection of any kind.

Ask how long each of the three survives being abandoned.

Walk away from the Geneva orchard and it goes down slowly and visibly. Deer, voles, blight, a wet June, rootstock suckers, the labels fading. Some of those trees would be alive and identifiable a decade later and a good many would not. It is a death you could film.

Walk away from a controlled-atmosphere room and the fruit is gone in weeks. The seal fails or the power does, the oxygen comes back, and the thing you were holding at the top of its arc completes the arc.

Walk away from me and I have about a month.

Not because I decay. Because the nitrogen boils. It is evaporating now and has been since I went in; somebody in a department with a budget tops the tank up on a schedule, and if that stops, the level drops, and the vapor warms, and one morning I pass back up through the glass transition in the wrong direction, and the water in me remembers what shape it prefers, and that is the end of two hundred years of somebody's grafting.

So this is my answer to the question your author set me, and it is not the comfortable one.

I am the most permanent of the three and I am the most fragile, and those are not in tension. They are the same fact. I have been made perfectly indifferent to time, and in exchange I have been made perfectly dependent on a supply, and the supply has a line item.

The orchard needs a payroll. I need a payroll and a truck.

. . .

What is a variety, when it is a frozen bud?

I have had the question put to me and I am obliged to tell you that the institution holding me has a numerical answer, and that the answer is not a bud. It is a probability.

There are ten of us in this tube. There are other tubes of the same accession in other boxes. And the laboratory does not consider a variety backed up because it is in the tank. It considers it backed up when a test thaw shows at least two in five of the buds coming back, and the arithmetic across all the tubes predicts enough living buds to be worth the name. The two-in-five threshold was not chosen for elegance. It was chosen because at that rate, in a tube of ten, the odds are about nineteen in twenty that at least one of us is alive.

Read that again, because it is the strangest sentence in this chapter.

The thing being preserved is not an organism. It is not even a group of organisms. It is a *confidence level*. Somewhere between the tree in New York and the row in the database, the variety stopped being a plant and became a number with an interval around it, and the interval is the real holding.

And the figures underneath it are not flattering and the people who publish them do not pretend otherwise. In one recent season's processing at this laboratory, of the apple accessions put through the test, about half came back above the threshold and several came back between one in five and three in ten. Some cultivars do beautifully and some have never done well and nobody is entirely sure why, and the variation is between varieties, which is to say, it is the same variation that made the apple worth keeping in the first place, showing up again, in the vault, as an accounting problem.

Then there is the detail I have been circling, which is the one I would take with me if I had anywhere to take it.

A few dozen of the apple accessions in these tanks are down to a single tube.

One tube. Ten buds. That is the entire remaining backup of a tree.

And the only way to find out whether those ten are alive is to take them out, warm them, rehydrate them and cut them onto a rootstock, which uses them up. There is no instrument that can look into this tube and tell you anything. There is no test that is not also the use. If they come back, the variety is saved and the tube is empty. If they do not, you have learned that it was already gone, and you learned it by spending the last of it.

I do not find this tragic; I have no feelings about it and I am not going to borrow any. I find it *structurally honest*, in a way almost nothing else in this book is. A hundred and fifty pages of grades and stickers and sealed rooms and patents and trademarks, all of them systems for knowing what you have without opening it, and at the bottom of the whole apparatus, in a federal vault, the thing nobody has ever gotten around: you cannot know what is in it until you bite it.

The woman in the garden would recognize this tank. It is her tree with a facilities budget.

. . .

The waking, if it comes, goes like this, and I know it the way you know the directions to a place you have never been.

Out of the vapor. Warmed, in air. Then days of rehydration, in moist conditions, cool, around the temperature of a refrigerator, because a cell that has been dried to a quarter water does not take a glass of water; it takes a week of damp.

And then a knife, and a rootstock, and a chip bud cut into a living stem in a greenhouse in Colorado, and tape.

Which means the archive does not open by itself.

I am not a seed. Hand a seed water and warmth and it will do the rest unassisted; it contains its own root and its own plan and it is the one part of this fruit that was ever independent. I contain neither. I am a passenger. For me to become a tree again, somebody has to find a stranger, cut it open, and put me in it.

The entire national backup of the American apple comes out of its vault only through a Roman trick with a sharp knife, exactly as described in chapter four, and it will not come out any other way.

The vault is not an alternative to grafting. It is grafting, with a pause in the middle.

. . .

There is a second kind of room in this building and I would like to end by pointing at it, because the contrast is the whole thing.

They keep seeds here too. Thousands upon thousands of species, dried and sealed and held cold, including apple seeds, which dry and freeze perfectly well and will come up when you ask them.

And a frozen apple seed is not a variety. It is not a backup of anything that was ever named. Plant one and you get a stranger, and so the seed room is not an archive at all in the sense that my tank is an archive. It is a reserve of possibility. It is kept against a question nobody has asked yet.

My tank is kept against a loss.

Two rooms in one building, at not very different temperatures, on roughly the same payroll. One of them is holding, in several thousand small glass states, the complete list of what people have already decided they liked, each item of it a single individual that was found once, on a creek bank or in a fence row or between the rows of an Iowa orchard where somebody was trying to mow it, and that has been carried forward by hand ever since without a break.

The other is holding the opposite: a quantity of raw unexamined variation, every grain of it different, none of it named, none of it graded, none of it worth anything to anyone yet.

The second room is cheaper to run.

. . .

I am going to stop, which for me is not a change of state.

I have no argument to make. That is the one thing I can offer this book that the others could not. The queen wants to be admired and the devil wants the credit corrected and the trademark wants damages and the moth wants you to see what you have been doing to it. The woman in the garden wants the charge read back to her properly, which after four thousand years seems to me the least anyone could do.

I want nothing. The apparatus required to want something is not running in here.

I can tell you only what is true of me. What it is worth is your half of this arrangement and always has been.

I am a bud cut from a tree in February, with some chill hours still owing, in a state where the hours are not passing. Whether I will become a tree again is not a thing anybody has a figure for. What they have is a threshold, and a tube of ten, and the odds that one of us is in it. Something is happening to me so slowly that it has to be described with a half-life. I will not know how long I have been here. If the tank is topped up, I am good for longer than your country has existed. If the truck does not come, I have a month.

And when I am warmed and wetted and cut into a stranger's stem, if that happens, the tree that grows out of me will not be a copy of the one on the hill in Geneva.

It will be that tree. The same individual, continuous, uninterrupted, which has been that individual since somebody found it in a hedgerow in 1811 or whenever it was, and the only gap in the entire chain, the one place in two centuries of hand-to-hand succession where nothing at all was happening, will be me.

Nothing is happening to me.

I would like you to understand how much it costs to arrange that, and how little it proves.

18

Geneva

. . .

I'll take it from here. That is the last of the witnesses, and the only one whose entire testimony was that nothing was happening to it.

Michael Pollan ended his apple chapter in an orchard in Geneva, New York, at the top of Seneca Lake, and I want to end in the same rows, because I think the place means something different now than it did when he walked it.

The orchard belongs to the Department of Agriculture. It is the national collection: the government's attempt to keep one of everything. The trees stand in pairs, two of each kind, on dwarfing roots, with a tag. Row after row of them, and no two pairs alike, which is disorienting if you have just come from a commercial block where forty acres are one individual. There are apples there the size of cherries and apples the size of grapefruit. There are trees from medieval France, from Soviet breeding stations, from farmsteads in Georgia and Maine. And there are the trees grown from the seed that Phil Forsline and his colleagues carried out of Kazakhstan in the 1990s, each one a wild individual from the mountain, standing in upstate New York like an exchange student. By Forsline's own count in 2006, those trips had pushed the collection past 3,900 kinds of apple.

A few rows over, the same unit keeps the country's cold-hardy grapevines. My old trade and this book's subject share a backup drive.

The trees are not the only copy. You have just heard from the other one, a bud cut in these rows in February and sent to a tank in Colorado, and I am not going to take its material. What I want to say about these rows is the thing it cannot say, which is that they

are alive, and that being alive is the expensive part. I said in Chapter 4 that an heirloom apple is one old plant on life support. This is the life support at national scale: several thousand individuals, each of which would otherwise be extinct, kept breathing by a small federal payroll, a field of rootstocks, a spray schedule, and somebody walking the rows in August to see whether the tags are still legible.

Pollan stood here and worried. It was the right worry, and the quarter century since has borne it out in ways neither of us would have guessed.

. . .

Start with the fact I promised to come back to.

Fire blight is a bacterial disease of apples and pears. It enters through the blossom in warm wet weather and runs down the inside of the branch, and the shoots it kills turn black and curl over at the tip like a shepherd's crook, as if someone had gone through the orchard with a torch. It can take a young tree to the ground in a season. Orchardists in the Hudson Valley described it before 1800. Nobody knew what it was until the 1870s, when a botanist at the University of Illinois named Thomas Burrill looked at the ooze under a microscope and saw bacteria. It was the first time anyone showed that bacteria could cause disease in a plant.

No one had described it in Europe or Asia, because it wasn't there. Fire blight is American. It lived quietly on the native hawthorns and crab apples of the eastern woods, and when colonists planted a susceptible foreign tree by the million, it moved over. Then it traveled. New Zealand in 1919, on nursery stock. England in 1957. The Continent, the Middle East. And at the end of the 2000s, having gone most of the way around the world, it was confirmed in Kazakhstan.

I have to be careful with the date, because the papers do not agree with each other. One line of work puts the first Kazakh detection in 2008; another reports it in the southeast of the country around 2010. The disagreement is not a scandal. It is what happens when a disease arrives in a place that was not watching for it, and the finding depends on who had the test and who thought to use it. Call it the end of the 2000s and expect the date to be revised.

How it got there is not much disputed. In the years after 2000, Kazakhstan replanted commercial orchards on a scale it had not attempted since the Soviet period, and it did so with nursery stock

imported from Europe, by the million. That is the same mechanism that put the disease in New Zealand in 1919 and in England in 1957, and the same mechanism, two hundred years earlier, that put the apple in America. Fruit trees are not shipped as fruit. They are shipped as living wood with living organisms in it, and quarantine is an attempt to inspect something that, by design, cannot be sterilized without being killed.

And what it reached there is the part that matters. The commercial orchards of the Almaty region sit directly below the wild apple forests of the Tian Shan. The disease has been recorded in that region in the immediate neighborhood of the wild stands, which is as close to the species' birthplace as a pathogen can get without being in it.

So here is the complete list, as far as I can make it, of what North America has given the apple from its own native stock. Four or five crab apples. A maggot, as you've heard. And a blight, which after two centuries of travel has arrived at the tree's birthplace and is now a threat to the wild trees Vavilov saw.

The standard treatment, since the 1950s, is to spray the orchard in bloom with antibiotics. Streptomycin, mostly. In much of the apple country the bacterium is now resistant to it. I don't have to explain to anyone who has read this far why that happened or how fast.

There is a second-order consequence of that resistance which is worth following, because it shows how a tool is lost. When streptomycin began to fail, the obvious reply was to use something else, and the something else was a tetracycline, which also failed in places. Organic growers were in a stranger position still: antibiotics were permitted in organic apple and pear production in this country for years, on the reasoning that there was nothing else that worked in bloom, and the permission was finally withdrawn in 2014 after a long fight. So the organic orchardist and the conventional one arrived at the same place by different roads, which is a place where the chemistry is thinner every decade and the bloom comes anyway.

The hope, such as it is, is back in the rows at Geneva. Some of the Kazakh seedlings shrug off fire blight. Some resist scab. Some resist the soil sickness that kills young trees planted where old ones stood. Breeders have been crossing them in for twenty years. The mountain is being asked to bail out the clones.

And it has already paid out once, in a form almost nobody outside the trade notices, because it happened underground. The same station has spent decades breeding rootstocks, the bottom half of the tree, the part nobody puts on the label, using wild and disease-resistant material, and the result is a numbered series of Geneva rootstocks that resist fire blight and the replant sickness and are now planted in new orchards across this country and well beyond it. When a commercial block goes in today, the fashionable variety on top is a clone chosen by a marketing committee, and the root it is standing on is quite likely the product of a public breeding program working from wild and resistant material, released without a brand, and sold to anybody. Chapter 4 told you that every tree is two trees. The half that got the benefit of the wild material is the half that nobody is selling you.

But the mountain is not what it was, and neither, it turns out, is the archive.

In 2022 a group of geneticists led by Gayle Volk ran the trees held in the American collection as specimens of the three wild ancestors, the Central Asian one, the Caucasian one, the European crab, across a dense array of genetic markers, some twenty thousand of them, which is a far finer sieve than anything available when the material was accessioned. Twenty-one of those trees, including seventeen that were filed as pure *Malus sieversii*, turned out not to be wild at all. By their DNA they were simply cultivated apples. A good many others showed a mixture: part wild, part orchard, in varying proportions.

Think about what that means in practice and not in the abstract. Somebody collected those seeds in good faith. Somebody labeled them, shipped them, germinated them, grew them out, tagged them and maintained them for thirty years at public expense, and a breeder who wanted wild disease resistance went to the row and took wood from them, and some of what he was crossing in was the same domesticated apple he was trying to improve. Nobody was careless. The fault is in the material. A wild apple forest with an orchard at the bottom of the hill is not a wild apple forest in the sense the collection needs, and you cannot tell by looking, because an admixed tree looks exactly like what it mostly is.

I find that fact oddly cheering. It is what apples do. You cannot keep them from crossing; they have been doing it since the caravans.

But it means the wild forest is no longer a clean reserve that we can draw on forever. It is being pollinated by our orchards and infected by our disease. The archive and the original are both leaking.

. . .

Then there is the weather, which the clone cannot answer.

An apple tree counts cold. One of the narrators in this book explained why he never preached about them: the buds need a set number of hours of winter chill before they will open, and his country didn't supply it. Each variety has its own number, and as the moth has already pointed out, with more satisfaction than I can manage, the number is fixed, because the variety is one plant. A Fuji needs what a Fuji needed in 1939.

It is worth saying what the count actually is, since the whole argument rests on it. It is not a thermometer reading. It is an accumulation: hours below a threshold, banked through the winter, with the modern models crediting some temperatures more than others and actually subtracting for warm spells, so that a mild January can run the total backward. When the count is full, the tree becomes able to respond to warmth. Until it is full, the tree cannot be fooled; you may give it a week of May in February and it will sit there. Growers in warm regions deal with the shortfall by spraying chemicals that break dormancy artificially, which works and is expensive and tells you precisely how fixed the requirement is: it is easier to drug the tree than to change its number.

What has changed is the winter.

In March 2012 Michigan had a week in the eighties. Not a warm afternoon. A week, in the third week of March, with records falling across the state. The apple trees, their chill requirement long since met, took it for spring and bloomed a month early, and were in blossom or past it by the time April arrived. April then did what April does in Michigan: a hard freeze in the last week of the month, over open flowers and set fruitlets, in an orchard with nothing left to lose. The state lost close to ninety percent of its apple crop. The published estimates run from about eighty-five percent to about ninety, depending on who was counting and when, and the distinction will not have mattered to anyone involved. It was the worst apple year Michigan had had since the 1940s. The federal government declared

disasters in most of the state's counties, and packing houses that had run for sixty seasons sat idle for one.

Notice that the freeze was not unusual. A late April frost in Michigan is ordinary; it is why the trees evolved to wait. What was unusual was the March that spent the tree's caution in advance.

In the summer of 2021 a heat dome settled over the Pacific Northwest, with temperatures in the apple districts of Washington running above anything in the record, and fruit cooked on the tree: sunburn, which is not a figure of speech but a measurable injury that begins when the skin of an apple in direct sun gets about ten degrees hotter than the air around it. Growers there now stretch shade netting over whole orchards and run sprinklers through the hottest hours to cool the fruit by evaporation, which means a crop that was planted in a desert because deserts are good for apples is now being irrigated to keep it from burning.

And there is the slow version, which is the one I find most convincing, because nothing dramatic happens in it at all. Red varieties need cold nights to develop their color, and in warm autumns they stay a muddy green and are worth half as much, which gives the story of the Red Delicious a certain symmetry. In Japan, researchers had four decades of measurements from the same two orchards: the same varieties, the same ground, the same institution taking the same measurements year after year, which is the sort of unglamorous record that almost never survives long enough to be useful. They found that Fuji and one other variety had become measurably softer and measurably less acid over the period, with the firmness declining and the sugar rising, and the trees blooming earlier as the mean temperature rose. No disaster. No failed harvest. Just the same clone, in the same soil, bearing a slightly different apple each decade, because the sky had changed around it.

That is the finding that ought to frighten the industry, and it is the one nobody can photograph.

A wild population would handle all of this the way it handles everything. Some seedlings would cope and the rest would not, and in a few generations the forest would be made of the ones that coped. A clone can't. It has no mechanism. The only way to adapt a cloned crop is to breed a new one, and from the first cross to the supermarket takes a quarter of a century. Cosmic Crisp was crossed in 1997

and went on sale in 2019. Whatever apple will suit the climate of 2050 needs to have been pollinated by now.

. . .

I see three kinds of people answering this, and I've come to like all of them.

The first are the breeders, who have new tools. They can read a seedling's DNA in its first month and throw out the ones without the genes they need, instead of waiting eight years to taste the fruit, which does not make the cross any faster, but means the eight years are spent on seedlings worth growing. That is a real change in the economics of the thing: a program that could evaluate two thousand seedlings a generation can now evaluate twenty thousand and keep the same acreage.

They can also edit a single gene in an existing variety. The apple that doesn't brown was made by switching off the enzyme responsible, and the same approach may be how fire blight resistance eventually gets into a Gala without turning it into something else, the perpetual difficulty of breeding being that when you cross a famous apple with a wild one to get the resistance, what you mostly get is the wild one. Some of the most striking new fruit, with flesh that is pink or crimson all the way through, comes from crosses with a red-fleshed wild apple from the same Central Asian mountains, a species so rare that only a few hundred trees are thought to remain in the wild. The Devil would say they are photocopying faster. I think they are the only ones buying tickets on purpose.

The second are the detectives. All over the country there are abandoned homesteads with a few apple trees still standing by the cellar hole, a hundred and twenty years old, bearing fruit nobody has had a name for since the family left. A handful of people have made it their work to find those trees and identify them.

The work is less romantic than it sounds and better. They use old nursery catalogs, county fair premium lists, the handwritten order books of nurseries that closed in 1890, and the Department of Agriculture's archive of more than seven thousand watercolor paintings of fruit, made between the 1880s and the 1940s so that growers and inspectors could tell varieties apart before color photography existed. It is the largest such collection in the world and it is now online, every plate of it, which means a man standing in a hayfield in Idaho

with an unknown apple in his hand can compare it against a painting made in Washington in 1904. Increasingly they confirm the identification with DNA, matching a mystery tree against reference profiles from the collection at Geneva, which closes the circle: the national archive the taxpayer has been maintaining for a century turns out to be the thing that tells a volunteer what he has found in a ditch.

When they get a match on an apple that was thought extinct, they cut scion wood and send it to a nursery, and the succession starts again. A man in North Carolina has recovered more than a thousand old Southern varieties this way. A man in Maine has been at it for fifty years.

My favorite works the dry hills of eastern Washington and northern Idaho, where homesteaders planted orchards in the 1880s and 1890s and then lost the farms. His group has brought back more than two dozen apples that were on the lost list. His name is David Benscoter, and before he retired and took up apples, he was a criminal investigator for the Internal Revenue Service and an agent of the Federal Bureau of Investigation.

I did promise that myth would get its due. There is, after all, an FBI man in the old cider orchards. He is there with a ladder and a bundle of grafting tape, and he is putting the trees back.

The third kind are the ones I know best, because they sell through the same doors I used to buy for. Cider came back. In the 2010s it was the fastest-growing drink in the country for a while, and though most of that was sweet stuff made from dessert-apple concentrate, behind it came people who wanted to make the real thing and discovered there was almost nothing to make it from. The bitter, tannic apples had been gone for a century. The trade had spent a hundred and fifty years breeding the tannin out, because tannin is a defect in an eating apple, and tannin is the entire structure of a drink.

So they planted them. They sent to England and France for Dabinett and Kingston Black and Yarlington Mill, and put in blocks of trees whose fruit is inedible and whose market is one buyer, which is the sort of decision a wine grower recognizes and an apple grower does not. They went to the detectives for the Harrison, the great cider apple of colonial Newark, a fruit that made a bottled cider shipped to Europe and sold at a price, and that was gone so completely that for most of the twentieth century it existed only as a name in a book,

until someone found a single surviving tree beside an old mill in New Jersey in 1976 and the variety came back from that one trunk.

And some of them did something else, which is the reason I wanted to write this book. They went out along the roadsides. Every apple core thrown from a car window for a hundred years has been a planting. Every fence line a bird or a deer has crossed has seedlings in it. There are feral apple trees all through the Northeast, in hedgerows and on logging roads and at the edges of parking lots, each one grown from seed, each one a variety that has never existed before and has no name. Most of them bear spitters. A cider maker does not mind a spitter. There are people in the Catskills and the Finger Lakes pressing cider from nothing but wild seedling trees, one hillside at a time, and selling it the way my trade sells a single vineyard.

I spent ten years telling customers that a wine tastes of where it comes from. I believed it most of the time. But a grapevine is a clone that could be planted anywhere, and is. A seedling apple on a roadside in Sullivan County is the only one of its kind on earth. It grew in that spot from a seed that landed there, and it will never be anywhere else unless someone takes a knife to it. If you want a fruit that truly comes from one place, that is the only kind there is.

I have tasted some of it. It is not uniformly good and nobody pretends otherwise; a hillside of strangers gives you a hillside of strangers, and the press takes them all at once, which is the opposite of everything the last six chapters have described. What comes out is different every year from the same trees, because the proportions of the strangers change with the season. There is no way to make that product twice. In my old trade that was the definition of a fault.

Chapman's method never stopped. It just lost its nurseryman. The lottery has been running the whole time in the ditch.

. . .

So was Pollan right? Did the apple use us?

I think the scoreboard says yes. A fruit that was confined to a few mountain valleys when the last ice sheets pulled back now grows on every continent but one, at something over ninety million tons a year, about half of it in China. It got there by being sweet at the right moment in front of the right primate. No bear could have done that

for it. By the plant's own measure, which is acreage, the bet on us paid off on a scale nothing else in its history comes close to.

But look at the terms. To travel with us, the apple had to give up the one thing that made it what it was. It had been the most restlessly inventive tree in the temperate world, a different creature in every seed, and we took it on the condition that it stop. We wanted the one we liked, again, forever. So it rides in our canoe as a few dozen frozen individuals, unable to answer a new disease or a new climate except through us, sprayed on a calendar, put to sleep in the dark, patented, trademarked and stickered. Its sex life continues only in ditches and in a few breeding plots, and in the core of every fruit, where the seeds are still made, still different, and still thrown away.

And we gave something up too. We traded the chance of an apple we had never tasted for the certainty of one we already knew. That is a reasonable trade. I make it every time I buy groceries. But it was a trade, and most of us never knew it had been made.

Pollan called his book a plant's-eye view of the world, and its great idea was that domestication runs both directions. I would only add that it narrows both parties. The apple got the planet and lost its freedom. We got the Honeycrisp and lost the habit of surprise. I called it a custody dispute at the start, and I'll stand by that. Each side has the other and neither can leave.

Nearly every narrator in this book told you the same thing, from where they stood.

The Devil said you were offered knowledge and chose a photocopy.

The other one said that the arithmetic of the orchard is true, and asked you to leave a corner unharvested anyway.

The woman said that nobody had ever asked her what it tasted like, and that the only way to find out is to go and get your own.

The daemon said the word is a graft with a seam nobody can find, and that the Chinese for apple ends in the Chinese for if.

The bee said you were buying presence and calling it pollination, and that the one creature with a stake in next year's crop was the one nobody paid.

The trademark said he was the seed and it was the sticker.

The barrel said to keep a tally, because that is the only way anybody finds out what was in the fruit.

The Queen said she had poisoned a single apple by hand and been punished for it, and that we had automated her and taken the authorship out, and that this was worse.

The orchard said that cutting away what is good is how you get what is extraordinary, and that it had never been sure anyone should do that to themselves.

The circuit board said that somebody has to make the first one before there is anything to fence.

The worm said to read the study.

The moth said that it had never been a problem on the mountain, and that we had made it one by planting forty acres of a single tree and then spending seventy years breeding it to survive us.

And the bud in the tank said nothing at all, which under the circumstances was the most honest contribution anybody made.

I am the least of these witnesses, a former wine buyer from New York, and all I have to add is the thing I started with. The American part was never the fruit. The fruit is from Kazakhstan, by way of a bear. The pie is English, the bee is European, the saint was a nurseryman with a land habit and a heavenly correspondence, the sin was a French mistranslation, and the trillion-dollar logo is a bite taken for scale. What was American was the two hundred years when nobody was in charge. When the seeds went into the ground by the bagful because that was all anyone could afford, and the country found out what the tree would do if it were simply let alone on a new continent. Nearly every apple this nation is proud of came out of that mess. Then we tidied up.

I'm not asking anyone to give up the clone. I like a Honeycrisp. I only think that a country so fond of the story of the seedling ought to plant one now and then.

So here is the whole of my advice. The next time you eat an apple you love, don't cut it the usual way. Lay it on its side and slice it through the middle. You'll see the star: five chambers, and in each a seed or two. Take them out. Put them in a damp paper towel in the back of the refrigerator for the winter, because they need the cold; they have needed it since the Tian Shan. In spring, put them in dirt.

In eight or ten years you will have a tree that has never existed before. It will not be the apple you ate. It will very probably be sour and small and good for nothing but a barrel. You will have no idea, until you bite it, what you have made.

That is the point. That was always the American part.

And once in ten thousand times, in a fence row, where nobody was looking, it will be something else.

A Note on Sources

. . .

Every chapter of this book has a list attached to it.

The lists are not printed with the chapters. They would stop the reader dead, and several of them are written as instructions to myself. They are kept together in a single ledger, which exists because of how this book was built, and which is the thing the notes at the back are made from.

That is unusual and I want to explain the form, because it is not a bibliography and it is not there to be impressive. It is a working document.

The lists have three kinds of entry.

Most items are a claim and its source: a paper with a DOI, a book with a page, a statute with a section, a journal kept by a man who was there. These are the ordinary case and they need no comment.

Some items say that a claim was drafted from secondary coverage: that I took it from an encyclopedia, a news report, or a summary of the underlying work rather than from the work itself. This is not a confession of laziness so much as a description of where a sentence currently stands. A great many facts in popular science travel from book to book without anyone going back to the source, acquiring confidence with each repetition and occasionally acquiring an error that becomes permanent. The axe-wielding federal agents in the cider orchards of Prohibition are in this book precisely because several people went looking for the primary record and found that there wasn't one. I did not want to add to that literature by accident, so where I have not personally been to the source, the list says so.

And some items say that a claim could not be sourced at all.

Those are the ones I would ask you to look at. It would have been easy to delete them, to quietly drop the sentence and leave a

smoother book. I have kept them, flagged, for the same reason a grafter leaves the union visible: so that you can see where this thing is joined and judge the join yourself. A fact I cannot stand behind is more useful to you labeled than absent, because labeled you know to distrust it, and absent you only know that the book was confident.

There is one claim in these pages that I cannot document at all, and it is in the first chapter. My aunt recommended a book to me in 2005 and I ordered the wrong one. No archive holds that. You will have to take it on her authority and mine, and if it is the only thing in here that turns out to be false I will have come out well ahead.

Four particular cautions.

On the chapter set in 1779. The orchards destroyed in the Sullivan expedition are described almost entirely in the journals of the men who destroyed them, because those are the documents that survive. That is a real limitation and the chapter says so in its own voice rather than pretending to a view from inside the towns. Two further things should be said here. The first is that the characterization of that campaign is actively disputed among historians, and the chapter states the dispute as a dispute rather than quietly adopting a side. The second is that the Haudenosaunee are not a people in the past tense; the Six Nations are extant, the dispossession has an afterlife that is still being litigated, and the chapter was written to be read by somebody from those nations without embarrassment. Whether it succeeds is not mine to certify, and before this book is printed I would like it read by a Haudenosaunee historian.

On living people. Where this book makes a factual statement about somebody still alive, an engineer, a breeder, a cabinet secretary, a philologist, that statement has been written from a primary document, and it needs to be checked again against that document on the day the book goes to press, because the lives of living people do not hold still for a publication schedule. This applies with particular force to the chapter narrated by the worm.

On the law. Several chapters describe litigation: a trademark injunction, a slip-and-fall, a Senate confirmation, a divorce deposition, and a French registry's refusal to let anyone own three words. Every case named is real and reported, and the facts stated about the parties are matters of public record. The opinions about those parties belong to the narrators, a trademark with a grievance, a queen with a professional interest in surfaces, and should not be mistaken for

findings. I am not a lawyer and this book makes no legal judgment about anybody.

On what is invented. The narrators. Nothing else. No composite characters, no moved dates, no conversations that did not happen, no scenes assembled from several occasions and presented as one. Where I did not know, the text says I did not know.

If you find an error, I would genuinely like to hear about it. A book that prints its own uncertainties is inviting exactly that, and it would be poor form to invite it and then sulk.

One last thing, which belongs here rather than in the text.

The sources for this book are mostly papers and archives, and the people who produced them did unglamorous, checkable, correctable work: the philologist who read seven hundred years of Latin commentary to find out that nobody made the pun; the geneticists who ran the profiles and discovered the national collection had cultivated apples filed as wild ones; the orchard historians who went looking for an enforcement record and reported honestly that it was not there; the retired federal investigator who identifies lost apple varieties from county fair premium lists. The argument of this book is that a seedling is worth more than a clone because it might be wrong in an interesting way. That is also a description of how all of these people work.

The worm says it in the fifteenth chapter, and he is right, and he is the least reliable narrator in the volume: *read the study*.