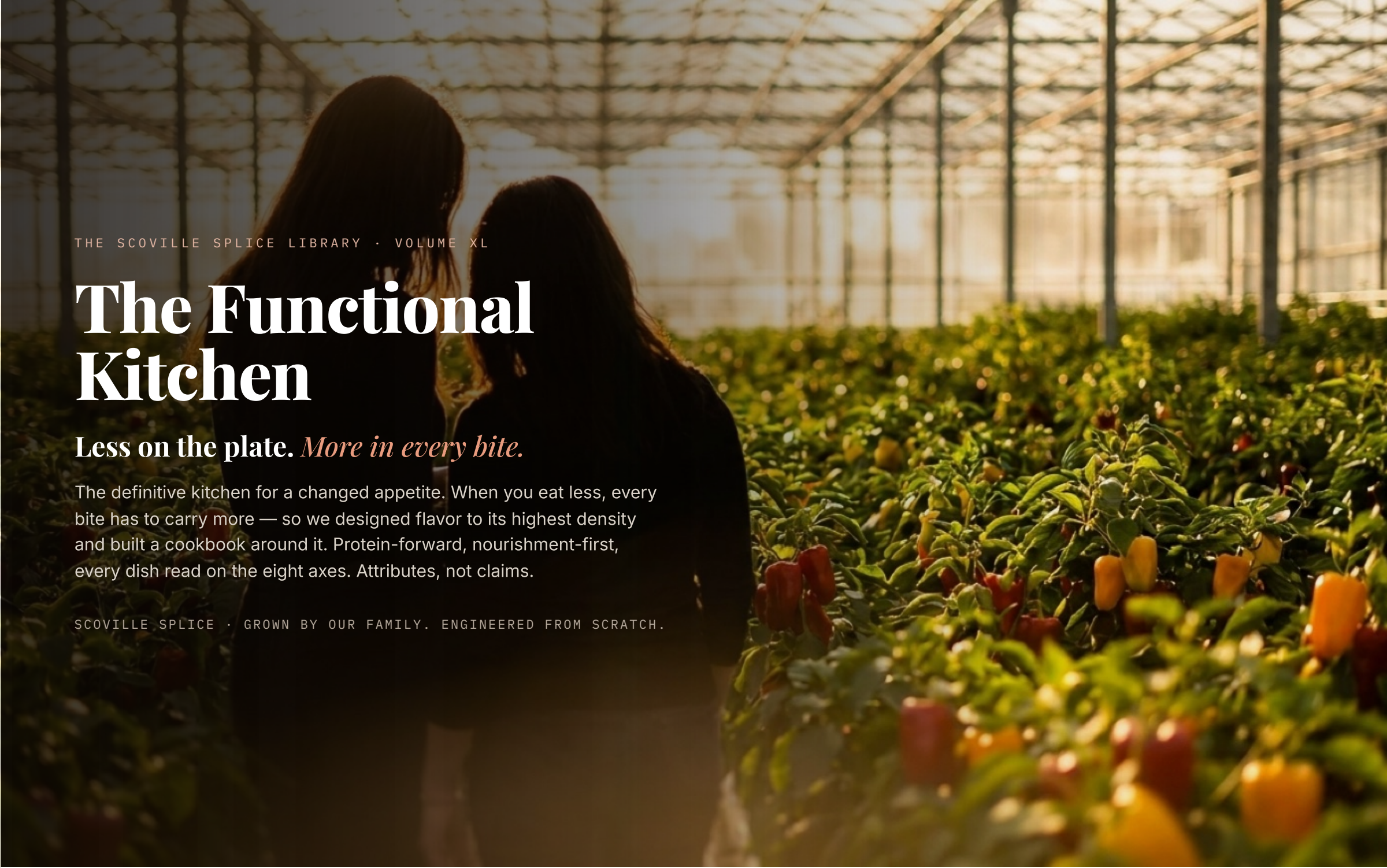

THE SCOVILLE SPLICE LIBRARY · VOLUME XL

The Functional Kitchen

Less on the plate. *More in every bite.*

The definitive kitchen for a changed appetite. When you eat less, every bite has to carry more — so we designed flavor to its highest density and built a cookbook around it. Protein-forward, nourishment-first, every dish read on the eight axes. Attributes, not claims.

SCOVILLE SPLICE · GROWN BY OUR FAMILY. ENGINEERED FROM SCRATCH.

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Opening essay · The smaller plate

There is a moment, somewhere in the second week, that the people who cook for a changed appetite all seem to describe the same way. The plate that used to be the beginning of the evening is now most of the evening. Half of it comes back to the kitchen. Food that once pulled you toward the table can sit there and say nothing, or worse, turn faintly against you — the roast that smells wrong, the sweetness that has gone flat and chalky, the coffee that reads as pure bitterness with none of the warmth underneath it. Hunger, the oldest conversation the body knows how to have, has grown quiet. A great many of us are living inside that quiet now, by choice and with our clinicians' blessing, and the kitchen has not caught up.

We wrote this book because the quiet does not have to mean the end of pleasure, and because the problem, read closely, is one our family happens to know how to solve. We are not clinicians and we make no claim about anyone's medicine; that conversation belongs to you and your doctor, and it stays there. What we are is a family of plant scientists who spent a decade learning to measure flavor and then to design it — molecule by molecule, receptor by receptor — and the thing a smaller appetite needs is precisely the thing we build. When the plate shrinks, the only variable left to move is *density*: how much flavor, how much nourishment, how much signal, each gram of food is able to carry. A full meal's worth of taste, folded into the few bites you actually want.



Our family in the research greenhouse — where the question behind this book first came up at the table.

For ten thousand years the kitchen could only add more. More salt, more sugar, more fat, a bigger portion — volume was the only lever anyone had, because no one could reach inside the ingredient and make it speak louder. We can. Every organism in this book has been tuned so that a given weight of it drives its receptor harder: the tomato that lost ninety-three percent of its savory depth to the industrial truck, grown back to a loudness it has not had since it came off a vine in someone's garden; the legume whose protein is made to taste like a reason to eat it; the sweetness that arrives clean and leaves nothing bitter behind. We measure all of it on one instrument, the Iyengar Flavor Index, so that for the first time a cook can look at a bite and read, in numbers, exactly how much it will say.

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IFI(c) = 1000 · EC₅₀(ref) / EC₅₀(c)
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That single line is the whole argument of this book, and we will come back to it until it is yours. EC_{50} is the concentration of a stimulus that drives its receptor to half of its full response — the molecular definition of *loud*. Invert it against a fixed reference, scale by a thousand, and you have a score that tells you not how much of a compound a food contains but how strongly that compound speaks when it lands on the tongue. Lower the EC_{50} — make the molecule a better key for its lock — and the same gram of food reaches the same intensity with far less of itself. That is density, stated exactly. It is also, as it turns out, the shape of a kitchen built for eating less and wanting it more.

What follows is that kitchen, in full. The science first, because the numbers are a form of respect — for the receptor, for the plant, and for you, who deserve to know *why* a bite works and not merely be told that it does. Then the pantry, every building block read on the index. Then the cooking itself: mornings gentle enough for a hesitant appetite, broths that fill the long middle of a bite, protein made genuinely delicious, vegetables people finish, sweetness kept honest and kept small. And underneath all of it, never spoken as a promise and never once a claim, the thing our family has always believed food is for — that you should be able to give your body the most nourishment it can hold, inside the smallest, truest, most pleasurable portion you actually want to eat. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.



PART I OF IV

The Density Argument

flavor per gram · the changed palate · protein made delicious · the architecture of fullness

Chapter 1 · The loudest bite — *flavor measured per gram, not per plate.*

Pick up a late-summer tomato — a real one, warm from the vine, the kind that stains your fingers — and bite it, and the savory flood that arrives is the single clearest lesson this book has to teach. That flood is glutamate reaching mGluR1 and the TAS1R1·TAS1R3 heterodimer, the umami receptors, in a concentration high enough to drive them hard. Now pick up the tomato that rode a refrigerated truck across a continent, picked green and gassed pink: botanically the same fruit, and almost silent. Somewhere between the two, roughly ninety-three percent of the free glutamate and the ribonucleotides that amplify it were never allowed to form, or broke down in transit. The receptor is identical in both cases. What changed is how *loudly* the fruit is able to speak to it.

This is the entire problem of eating less, in miniature. When the appetite is large, a quiet tomato is forgivable — you simply eat more of it, and volume makes up for loudness. When the appetite is small, there is no more. The quiet tomato stays quiet, and the plate, however large, delivers a fraction of the pleasure and the nourishment it should. The only way out is to make the gram itself louder. So that is what we measure, and what we design, and it begins with giving loudness a number.



A cross-section of our umami-restored tomato — the savory depth the industrial supply chain removed, engineered back through the fruit's own GAD and GDH1 routes.

Loudness, defined

The Iyengar Flavor Index does not measure how much of a compound a food contains. A milligram count would tell you almost nothing — a gram of a weak agonist can be inaudible while a milligram of a strong one is a shout. What matters is the receptor's own sensitivity to the molecule, and the single number that captures it is the half-maximal effective concentration, EC_{50}: the concentration at which the stimulus drives its receptor to exactly half of its

maximum response. A low EC_{50} means the receptor answers to a whisper. A high one means you have to flood it. Loudness is the inverse of EC_{50}, and the Index is built on that inversion:

$$IFI(c) = 1000 \cdot EC_{50}(\text{reference}) \,/\, EC_{50}(\text{candidate})$$

We fix a reference stimulus per axis, set its loudness near the low end of the scale, and read every candidate against it. A cultivar whose active has an EC_{50} eight times lower than the reference scores roughly eight times higher. For scorecards we normalize each axis to a ceiling of 5,000, which is comfortably above anything that grows without our help and leaves headroom for the full-spectrum constructs at the far frontier of the library. On this scale a sunlit shishito's heat sits near 40; our restored tomato's umami, which the wild-harvest fruit delivers at an IFI-U near 300, our model predicts comes back to **2,600**.

AXIS	CODE	RECEPTOR	WHAT A HIGH SCORE MEANS ON THE PLATE
Heat	IFI-H	TRPV1	warmth, the slow spreading burn
Sweetness	IFI-S	TAS1R2·TAS1R3	clean sweetness, no sugar required
Umami	IFI-U	mGluR1 · TAS1R1·R3	savory depth, the taste of a broth
Zero-Bitter	IFI-B	TAS2R38	bitterness turned down, 20–65%
Kokumi	IFI-K	CaSR	richness, continuity, mouthfeel
Cool-Burn	IFI-C	TRPM8	coolness, brightness, a palate waking
Pungency	IFI-P	TRPA1	the sharp edge — mustard, ginger, garlic
Astringency	IFI-A	salivary PRPs	structure, a clean dry finish

From loudness to density

Loudness is a property of the molecule. Density is a property of the *bite* — and it is loudness put to work. To see the connection, we need the shape of the receptor's response, which is not a straight line but the sigmoid every pharmacologist knows, the Hill equation:

$$\theta = c^{\,n} \,/\, (EC_{50}^{\,n} + c^{\,n})$$

Here θ is the fraction of the receptor's maximum response, c is the concentration of the active that your bite actually delivers to the tongue, and n is the Hill coefficient, the steepness of the curve — for most taste receptors n sits between 1 and 2. Set c equal to EC_{50} and θ is exactly one-half, which is simply the definition of EC_{50} read

backward. The useful part is what happens when we lower EC_{50} by engineering the active to bind its receptor better. To reach any chosen intensity θ, you need a concentration c that scales directly with EC_{50}. Cut EC_{50} in half — double the IFI — and you reach the same θ with half the concentration, which for a whole food means roughly half the grams.

That is density, and here is what it buys a small plate. Our restored tomato's umami EC_{50} is lower than the wild-harvest fruit's by the same factor its IFI-U rose — from 300 to 2,600, a factor of about 8.7. A cook feeding a large appetite might reach a satisfying savory intensity with 90 grams of ordinary tomato. The same intensity arrives in roughly **ten grams** of ours. The difference is not a trick of seasoning; it is the EC_{50} moved, the receptor driven just as hard by a tenth of the mass.

	WILD-HARVEST TOMATO	RESTORED TOMATO	FACTOR
IFI-U	300	2,600	×8.7
Relative umami EC_{50}	1.00	0.115	÷8.7
Grams for the same savory intensity	~90 g	~10 g	÷8.7
Free glutamate restored	baseline	+93% of lost pool	—

The steepness of the curve

One refinement separates a rough estimate from a precise one, and it changes how a small plate behaves. The Hill coefficient *n* is not decoration on the equation; it is the receptor's *cooperativity* — how sharply its answer switches from silent to saturated as concentration climbs. At *n* = 1 the receptor ramps up gently, crossing from nothing to nearly everything across a hundredfold span of concentration. At *n* = 2 the ramp is steep: near-silent, then over barely a tenfold change it leaps to near-full response. The sweet and umami receptors, built as cooperative heterodimers of two subunits, sit toward the steeper end, which is why sweetness and savoriness can seem to arrive all at once rather than creep in.

Cooperativity is quietly decisive for a changed appetite. A steep curve means a narrow band of concentration where the axis goes from imperceptible to fully present — you want to be just above its floor and just below its ceiling, with little room between. Below the band an ingredient reads as absent, and a cook wrongly concludes it is weak; above it, mass is spent and an off-note risks surfacing, which on a dulled palate is the worst outcome. The loud designed ingredients are precious precisely because their low EC_{50} places that narrow, decisive band at a tiny mass: a fraction of a gram lands in the middle of the steep rise, where a very little does a great deal. Loudness is not only grams saved. It is grams delivered to the one part of the curve where they count.

IFI RATIO (DESIGNED ÷ BASELINE)	EC_{50} RATIO	GRAMS FOR THE SAME INTENSITY	READING
×2	÷2	÷2	a modest restoration
×4	÷4	÷4	a strong tuning
×8.7	÷8.7	÷8.7	our restored tomato, 300 → 2,600
×15	÷15	÷15	the far edge of what we build

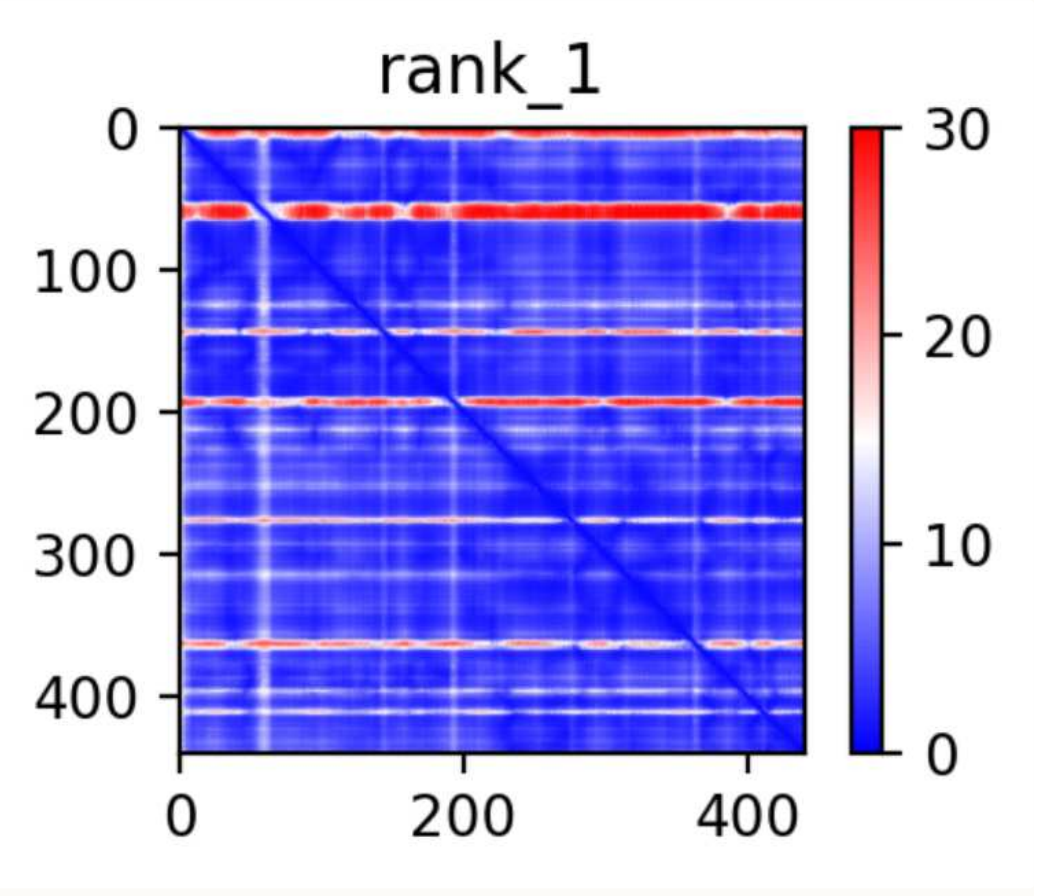
The table is only the density logic held to the one real anchor we have and carried out as arithmetic: whatever factor the IFI rises, the EC_{50} falls by the same factor, and the grams a small plate needs fall with it. Everything else in this book is this single line, applied eight ways.

We will not pretend one axis is a meal. A tomato is not dinner, and density on a single receptor is only the first move. But the logic holds across all eight, and it is the logic the whole book runs on: *do not add more food to a quiet ingredient; build an ingredient loud enough that a small amount is enough.* When you eat less, that is not a nicety. It is the only arithmetic that works. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 2 · A palate that changed — *the receptors, and what the quiet touches first.*

The second thing the people cooking for a smaller appetite describe, after the half-full plate, is that food simply tastes *different* — and not uniformly. Sweetness tends to dull first and most, flattening into something faintly metallic or chalky. Rich, fatty, heavily savory things can tip from pleasure into aversion, the smell of cooking meat suddenly too much. Bitterness, meanwhile, seems to grow teeth: coffee reads as its bitter edge alone, vegetables as their bitter edge alone, the balance that used to carry them gone. This is not imagination and it is not uniform noise. It is a specific, legible pattern of change across the taste receptors, and once you can read it you can cook against it with precision. That is all this chapter is: the eight locks, and which ones the quiet reaches first.

We say again, plainly, so it is never in doubt: we are describing a palate, not a medicine, and we make no claim that any food changes what a medicine does. We cook for the tongue as we find it. What we have found, across the family and the many cooks who tested these pages, is that the changed palate has a shape — and that the Index, which was built to design flavor, turns out to be exactly the map you need to meet it.



We read a protein's structure before we ever touch the plant — here, the predicted-alignment-error map of the Pun1/AT3 model that anchors our heat work, the same method we use to understand every receptor's ligands.

The sweet lock, and why it dulls

Sweetness is read by a single receptor, the TAS1R2·TAS1R3 heterodimer, a class-C G-protein-coupled receptor built from two subunits each shaped like a Venus flytrap. Sugars and the high-potency sweeteners settle into the cleft of that flytrap and close it; the closure is the signal. When the palate reports sweetness as flat or metallic, the usual culprits are a raised effective threshold — the receptor needs more to answer — and the unmasking of a faint bitter or metallic co-signal that a healthy sweet response would have buried. The wrong response is to pile in more sugar, which lands as bulk and cloying weight without ever restoring the brightness. The right response is a *cleaner, louder* sweet agonist: one with a low EC_{50} at TAS1R2·R3 and, critically, no activity at the bitter receptors. We will spend all of Chapter 6 there. For now the number to hold is that the designed steviol glycosides and mogrosides we use reach the sweet receptor at concentrations two to three hundred times lower, by weight, than sucrose — a very low EC_{50}, a very high IFI-S — which is exactly the loudness a dulled sweet lock needs.

The savory locks, and why they can turn

Umami is read by mGluR1 and by the TAS1R1·TAS1R3 heterodimer, and it has a property no other axis shares: *synergy*. Glutamate alone closes the flytrap and signals, but add a 5′-ribonucleotide — inosinate (IMP) from aged and cooked tissue, guanylate (GMP) from mushrooms — and the ribonucleotide binds an adjacent site on the TAS1R1 subunit, props the closed conformation open-side-shut, and drops glutamate's effective EC_{50} by nearly an order of magnitude. The classic measurement is stark: a 1:1 mixture of glutamate and IMP tastes roughly **seven to eight times** as savory as the same total weight of glutamate alone. Umami is the one axis where the cook gets a multiplication rather than an addition for free, and in a kitchen built on density that multiplication is treasure.

Why, then, does rich savory food sometimes turn against a quiet appetite? Not usually because of umami itself, which reads as clean and welcome, but because of what travels with it in conventional cooking — concentrated fat, strong aroma volatiles, heavy browning. The move this book makes again and again is to split them apart: keep the umami, keep the kokumi richness, and carry them on a lighter, cooler, brighter vehicle so the savory depth arrives without the fatty freight that tips into aversion. You will taste that strategy most clearly in the broths of Chapter 10.

The bitter lock, and why it sharpens

Bitterness is read by some twenty-five TAS2R receptors, the most studied of which, TAS2R38, responds to the thiourea compounds in the mustard-and-cabbage family and sets much of a person's sensitivity to the glucosinolate bitterness of Brassica. Bitter perception is governed partly by genetics — the PAV and AVI haplotypes of TAS2R38 famously divide the world into those who taste phenylthiocarbamide as punishing and those who barely register it — and partly by context, because a healthy sweet, umami, and kokumi response actively *suppresses* bitterness at the level of the brain's integration, not just the tongue. When the other axes dull, that suppression weakens, and bitterness that was always present

steps forward uncovered. This is why the same cup of coffee can go from rounded to harsh. Our answer is the Zero-Bitter axis, IFI-B: cultivars designed to lower the bitter agonist itself — 20 to 65 percent less in our computational model — so the vegetable or the bean is smoother at the source rather than drowned in sugar and cream. Chapter 7 is its home.

One cascade, five tastes

It helps to know that sweet, umami, and bitter — three of the locks this chapter has named — do not each own a private wire to the brain. They share a single machine downstream of the receptor, and understanding it explains why the changed palate shifts the way it does, in concert rather than at random. When a sweet, umami, or bitter molecule binds its GPCR, the receptor activates a taste-specific G-protein whose α-subunit is gustducin and whose βγ-pair is the active messenger. The βγ switches on phospholipase C-β2 (PLCβ2), which cleaves a membrane lipid to release inositol trisphosphate (IP_3); IP_3 opens its receptor on the cell's internal calcium store; the released calcium opens TRPM5, a cation channel that depolarizes the taste cell; and the depolarization drives ATP out through the CALHM1 channel to the waiting afferent nerve. Sweet, umami, bitter — three different front doors, one shared hallway of PLCβ2 → IP_3 → calcium → TRPM5 → CALHM1.

That shared hallway is why the axes move together, and why a cook cannot treat the changed palate as eight independent dials. Whatever dampens the common machinery dampens all three at once; and conversely, a strong, clean signal on one axis can lift the whole cell's output and, with it, the brain's integrated read. This is the mechanism behind the oldest move in seasoning — that a pinch of salt or a note of umami makes a dish taste sweeter and less bitter, not by touching the sweet or bitter receptors at all but by changing how the shared signal is weighed downstream. The functional kitchen leans on this constantly. When we build a dessert on a floor of kokumi and a whisper of salt, or a bitter vegetable on a bed of umami, we are not masking — we are feeding the shared cascade a strong, welcome signal that changes how everything else on the plate is read. The eight axes are the front doors. The pleasure is assembled in the hallway. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

The locks the Index was built to find

The remaining four — kokumi at the calcium-sensing receptor CaSR, cool-burn at TRPM8, pungency at TRPA1, astringency at the salivary proline-rich proteins — are the ones conventional cooking barely names and the ones that turn out to matter most for a changed palate, because they are not, strictly, *tastes* at all. They are sensations of richness, coolness, sharpness, and structure that run alongside taste and shape how full, how bright, and how finished a bite feels. A quiet appetite is unusually responsive to them: a touch of cool wakes a flat palate, a thread of pungency pulls attention to a dish, a well-built kokumi makes a thin thing feel complete. We designed our organisms to speak all eight. The next two chapters

take the two that do the heaviest lifting — the savory depth that makes protein worth eating, and the kokumi that makes a small bite feel like enough.

Chapter 3 · The weight of protein — *umami and kokumi make a legume taste like a meal.*

Of everything a smaller appetite needs, protein is the one the clinicians and the cooks agree on without argument, and the one the changed palate makes hardest to eat. The body still needs its grams — to hold muscle, to carry a person through a day on far less food — but concentrated animal protein is exactly the category most likely to read as too rich, too strong, too much. Plant protein is gentler on the palate and, grown and prepared our way, gentler on the planet and the body both; the trouble has always been that a plain legume, honestly, can taste like obligation. This chapter is about ending that — about making a soybean or a lentil taste like something you actually want, which is not a matter of disguise but of giving the protein its own savory voice. We are a vegetarian-first kitchen and this is where that conviction earns its keep: not as a restriction, but because plant protein is the richest canvas we have for the two axes that make savoriness.



Our high-γ-glutamyl soybean — the protein staple we tuned to carry both the umami depth and the kokumi richness a changed palate needs most.

The glutamate the plant already makes

A soybean is not savory by accident; it is savory by biochemistry it already possesses, running slightly too quiet. Free glutamate — the molecule that *is* umami at mGluR1 — sits at the hub of the plant's own nitrogen metabolism, made and unmade constantly by two enzymes we know intimately. Glutamate dehydrogenase, GDH1, builds glutamate from α-ketoglutarate and ammonia, drawing on the carbon skeleton that the citric-acid cycle hands it and the nitrogen the plant has fixed. Glutamate decarboxylase, GAD, pulls it the other

way into the GABA shunt. Where free glutamate accumulates — and therefore where a tissue tastes savory — is set by the balance between those two fluxes and by how much the plant locks its glutamate away into protein and transport rather than leaving it free on the tongue's terms.

We do not add anything foreign to make a soybean savory. We rebalance its own routes: nudging GDH1 and the aminotransferases that feed the free-glutamate pool, easing the drain into storage, so that at the moment of harvest and cooking the free-glutamate concentration lands high. It is the identical logic by which we restored the tomato — the same GAD/GDH1 lever the exemplar volume describes — applied to the richest protein source in the garden. Our model predicts a soybean whose IFI-U climbs well into four figures from a wild-type baseline near the tomato's old 300, which means a given weight of it would drive the umami receptors far harder, which means a modest portion of tofu or tempeh tastes like a savory event rather than a penance.

The nitrogen hub, read as flavor

It is worth lingering on *why* a soybean carries so much savory potential, because it is the same reason it carries so much protein, and the two are one fact. Glutamate sits at the exact center of a plant's nitrogen economy. Nitrogen taken up as ammonium is first married to carbon through the GS/GOGAT cycle — glutamine synthetase (GS) attaches ammonium to glutamate to make glutamine, and glutamate synthase (GOGAT) hands that nitrogen onto a molecule of α-ketoglutarate to make two glutamates. From this hub, transaminases distribute the amino group outward to build every other amino acid, and therefore every protein. Glutamate is not one amino acid among twenty; it is the doorway through which nitrogen enters the whole of the plant's biochemistry. A legume, built to pack protein, runs that hub hard — which is precisely why it holds the raw material to taste profoundly savory, if the free pool is allowed to stand rather than be swept entirely into storage protein.

So our work on the soybean is not an addition of foreign savor; it is a re-apportioning of the plant's own nitrogen hub toward free glutamate at the moment that matters. We ease the GDH1 and transaminase fluxes that feed the free pool, gentle the drain into storage protein and the GAD-driven exit into the GABA shunt, and time it to harvest, so the tissue arrives on the tongue with its free glutamate high while its total protein stays intact. The flavor and the nourishment rise together because they draw on the same hub — the most satisfying result in this whole kitchen, because it means making the legume delicious and making it nourishing are not a trade-off but the identical intervention. We did not choose between taste and protein. The plant's own chemistry refused to let them be separated.

The synergy, cooked in

Chapter 2 named umami's gift — the near-eightfold potentiation when glutamate meets a 5′-ribonucleotide — and the protein plate is where a cook spends it. The ribonucleotides come from two

directions. Guanylate (GMP) is concentrated in mushrooms, dried shiitake most of all, where the drying itself generates it. Inosinate (IMP) forms in aged and gently cooked tissue. Our shiitake and our koji are tuned to push GMP high; the move in the kitchen is simply to let the glutamate source and the ribonucleotide source meet — a tofu braised in a dried-shiitake stock, a lentil finished with a koji paste — so that the two sit on the tongue together and the receptor reads their product, not their sum.

```
U(combined) ≈ k · [glutamate] · (1 + β · [ribonucleotide])
```

That cross term, β·[ribonucleotide], is the synergy made algebra: a small amount of GMP or IMP multiplies the umami the glutamate was already going to deliver. For a dense kitchen it is the best bargain on the menu, because the multiplier costs almost no mass. A few grams of powdered dried shiitake can lift the perceived savoriness of an entire bowl, and on a small plate that economy is everything.

ORGANISM	CONSTRUCTS	AXES	ROLE ON THE PROTEIN PLATE
Soybean	360	U · K	the staple — tofu, tempeh, edamame; glutamate + γ-glutamyl both tuned up
Koji Mold	80	U	the ferment engine — amino-acid release, GMP/IMP, deep savory pastes
Shiitake	80	U	the ribonucleotide source — dried, the synergy partner
Yeast	240	U · K	savory + kokumi in one — spreads, broths, finishing
Mushroom	40	U	broth body, the clean savory base
Garlic	560	K · P	kokumi backbone + the sharp edge that wakes a plate

The honest limit

We will say the quiet part plainly, because a book for this reader must. We are describing attributes we build into food — savory loudness, protein density, continuity — and nothing beyond them. We make no claim that a soybean does anything to a medicine, to a body's metabolism, or to a condition; those are not ours to claim and we do not make them. What we claim is narrow and entirely true: that a legume can be made to taste like a reason to eat it, and that when protein tastes like something you want, a body on a small intake is more likely to receive the grams it is already reaching for. That is a statement about flavor and about finishing a plate, not about physiology. We keep that line as bright as we can hold it. The

kitchen's job is to make the nourishing delicious; what the nourishment then does belongs to you and your clinician, and we leave it, gladly and completely, in your hands.

What it means on the plate

Protein, made genuinely delicious, is the quiet revolution of this kitchen. When a block of our tofu reads at an IFI-U in the thousands and carries a kokumi richness beside it, a person eating a third of their former portion gets the savory satisfaction — and the grams of protein — that used to require a full plate they can no longer finish. We are not hiding the legume behind sauce. We are letting the legume, tuned to its own loudest honest self, finally taste like the meal it always had the nitrogen to be. The recipes of Chapter 11 are built entirely on that premise, and the first time a skeptical eater finishes a small bowl of marinated tempeh and asks for the recipe rather than leaving half, you will understand why we think this axis, on this plate, matters more than any other in the book. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 4 · The architecture of fullness — *kokumi, continuity, and the long middle of a bite.*

Umami tells you a thing is savory. Kokumi tells you it is *enough*. It is the hardest of the eight axes to name because the language of eating never had a steady word for it — "mouthfeel," "body," "roundness," "that broth-cooked-all-day quality" all circle it — but the moment you can feel it as its own dimension, a changed appetite starts to make a new kind of sense. Kokumi is continuity: the way a great stock fills not just the front of the bite but its long middle and its finish, the way a thin soup can taste watery and a well-built one taste complete at the very same calorie count. For a person eating small, continuity is not a luxury. It is the difference between a few bites that satisfy and a few bites that leave the body still asking. This chapter is about building it on purpose, from the receptor out.



A cut clove of our high-γ-glutamyl garlic — the kokumi backbone of the kitchen, where the peptides that fill the middle of a bite are made.

The calcium-sensing receptor, borrowed by the tongue

Kokumi compounds act on CaSR, the calcium-sensing receptor — a class-C GPCR the body uses throughout its tissues to monitor calcium, quietly repurposed on the tongue to read a specific family of molecules: the γ-glutamyl peptides. The best known is glutathione, γ-glutamyl-cysteinyl-glycine, the same tripeptide that works as the cell's master antioxidant; others, like γ-glutamyl-valyl-glycine, are more potent kokumi agonists still, active at the receptor in the low micromolar range. What makes them strange and

wonderful is that on their own they taste of almost nothing. They are modifiers. Present alongside umami, sweetness, or saltiness, a CaSR agonist amplifies and *prolongs* the other tastes — raising their perceived intensity, thickening the texture, and above all extending them through the middle and the finish of the bite. Kokumi is, almost literally, the receptor that makes a taste last.

The peptides are made along the plant's glutathione machinery. γ-glutamylcysteine synthetase (the GSH1 step) joins glutamate to cysteine through the unusual γ-linkage — the bond that runs off glutamate's side-chain carboxyl, not its backbone — and glutathione synthetase (GSH2) adds the glycine. A transpeptidase, γ-glutamyltransferase (GGT), then shuffles the γ-glutamyl group onto other amino acids to generate the wider family, γ-Glu-Val-Gly among them. Garlic, onion, yeast, and soybean are naturally rich in this chemistry; aged garlic and long-fermented pastes are rich in it precisely because time and enzymes keep building γ-glutamyl peptides. Our contribution is to raise the pool at the source — tuning the GSH1/GSH2 flux and the GGT activity so the harvested tissue arrives already deep in kokumi, rather than requiring days of fermentation to get there.

The peptides, and why the γ-bond matters

The kokumi peptides are specific enough to be worth naming, because a cook who knows them knows where richness comes from and how to build it. The active family is the γ-glutamyl peptides: glutathione (γ-Glu-Cys-Gly), its precursor γ-glutamylcysteine (γ-Glu-Cys), and the short, potent γ-Glu-Val-Gly, among the strongest kokumi agonists known and active at CaSR in the low micromolar range. What they share, and what their activity depends on, is the γ-linkage itself — the peptide bond formed off glutamate's *side-chain* carboxyl rather than its backbone. Swap it for an ordinary α-bond and the molecule goes quiet at the receptor; the γ-bond is the recognition feature, the thing CaSR is reading. This is why kokumi is a chemistry that time and fermentation generate so reliably: the enzymes that build and shuffle γ-glutamyl groups work slowly, and an aged garlic or a long-fermented paste is, molecule by molecule, a richer kokumi source than its fresh self.

CaSR itself is a class-C GPCR, cousin to the sweet and umami receptors, built from a large extracellular Venus-flytrap domain atop a seven-transmembrane bundle. Calcium and the γ-glutamyl peptides bind the flytrap and shift it toward its active, closed conformation; the synthetic calcimimetics used in medicine bind the transmembrane bundle at a separate site and do the same, which is how we know the receptor has two routes to activation. The peptides are what the tongue reads, and their effect — the thing you actually feel — is not a taste of their own but a potentiation and *prolongation* of the tastes around them, lifting umami and sweetness and salt and, above all, carrying them through the middle and the finish of the bite. We raise the pool at the source by tuning the plant's glutathione machinery, so the harvested tissue arrives already deep in the peptides that fermentation would otherwise need days to build. Continuity, bought at the gene rather than at the clock.

Continuity, measured

On the Index, kokumi is IFI-K, anchored like every axis to the half-activation of CaSR by a reference γ-glutamyl peptide. Our high-kokumi garlic and yeast reach IFI-K values in the high four figures; Phoenix, the full-spectrum flagship at the far end of the library, registers K at 1,900 as one voice among eight. But the number that matters for a small plate is not the peak — it is what the peak does to *duration*. We measure kokumi's signature as the area under the perceived-intensity curve of a bite over time: a high-kokumi broth and a low-kokumi one can start at a similar peak, but the high-kokumi version sustains its intensity through the swallow and past it, so the integral — the total flavor experienced per bite — is far larger. Density, again, but density in the time dimension rather than the mass dimension. A bite that lasts is a bite that satisfies, and a satisfied small appetite is the whole project.

ORGANISM	CONSTRUCTS	IFI FOCUS	WHAT IT BUILDS
Garlic	560	K · P	the backbone — continuity plus a sharp top edge
Yeast	240	U · K	savory and continuity at once, a finishing lever
Onion	40	K	sweet-savory base, the long slow note
Vanilla	40	K	kokumi for the sweet side — roundness in dessert
Soybean	360	U · K	protein, umami, and continuity in one staple

The long middle, in the kitchen

Everything this book cooks is, at bottom, an exercise in building continuity into a small portion — so that the few bites a changed appetite wants are each complete from front to finish rather than a bright opening that falls away to nothing. Kokumi is the axis that does it, and it is nearly invisible: no one tastes a γ-glutamyl peptide and names it, they simply feel that the soup was *good*, that the bite was *enough*, that they are, surprisingly, satisfied. We build it with our high-kokumi garlic and onion in every base, with a finishing whisper of savory yeast, with the γ-glutamyl depth our soybean carries on its own, and with time where time helps. In the chapters ahead you will see IFI-K scored on nearly every dish, often as the quiet high number beside the louder umami, and now you will know what it is doing: holding the middle of the bite open, keeping the pleasure and the nourishment present all the way through the swallow, so that less food reaches further into the body's sense of enough. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.



PART II OF IV

The Functional Pantry

the cultivar ladder · sweetness without sugar · the vegetables people finish · brightness, cool, and the sharp edge

Chapter 5 · The pantry ladder — *every building block, read on the index.*

A kitchen is only as good as its pantry, and a functional kitchen is only as good as how *loud* its pantry is. This chapter is the one you will come back to — the standing inventory of the designed organisms this book cooks with, each read on the Index so you can reach for density on purpose. Think of it the way we think of it in the greenhouse: not as a list of ingredients but as a set of voices, each one tuned to say a particular thing clearly, so that a cook assembling a small plate can decide which axes that plate needs and pull exactly the building blocks that carry them. We have forty-two host organisms live across the library today, backed by roughly 225 distinct construct designs that the platform has built into approximately 19,500 product packages; what follows is the subset that does the work of a daily kitchen, organized the way a cook actually reaches.



The pantry's quiet star — our umami-restored tomato, the single most useful loud ingredient a small plate can own.

The savory core

These are the organisms that carry umami and kokumi — the protein plate, the broths, the bases. If you stock nothing else, stock these.

ORGANISM	CONSTRUCTS	PRIMARY AXES	DIFFICULTY	STANDING USE
Tomato	2,040	S · U · F · M	Easy	the universal savory-sweet base; IFI-U restored 300 → 2,600
Soybean	360	U · K	Frontier	tofu, tempeh, edamame — protein with its own voice
Garlic	560	K · P	Moderate	kokumi backbone, sharp top edge
Yeast	240	U · K	Hard	finishing savory and continuity in one
Koji Mold	80	U	Hard	ferment engine — pastes, marinades, amino release
Shiitake	80	U	Hard	the ribonucleotide source; dried, the synergy partner
Mushroom	40	U	Hard	clean broth body
Onion	40	K	Moderate	the long slow base note

The sweet and clean

Sweetness without the sugar load, and the bitterness-attenuated produce that lets vegetables be finished. The density story at its most direct — very low EC_{50} sweeteners, very high IFI-S.

ORGANISM	CONSTRUCTS	PRIMARY AXES	DIFFICULTY	STANDING USE
Stevia	910	S · F · M	Moderate	the workhorse sweetener; Reb-clean profile
Monk Fruit	80	S	Hard	the cleanest sweet, no tail; mogroside V
Sugarcane	200	S	Frontier	sweetness density without the full sugar mass
Broccoli	380	B · M	Moderate	the vegetable people finish; 20–65% less bitter
Broccoli-Kale	280	B	Hard	the hybrid green, bitterness tuned down
Coffee	40	B	Hard	the rounded cup — bitter edge attenuated
Cocoa	40	B · A	Hard	fine chocolate, bitterness and tannin balanced

The brighteners and the edge

The axes that wake a flat palate — cool, pungent, astringent, and a gentle designed heat. These are used in small strokes, but on a changed palate the small stroke is often what turns a dish on.

ORGANISM	CONSTRUCTS	PRIMARY AXES	DIFFICULTY	STANDING USE
Peppermint	2,360	C · M	Hard	cooling and brightness; the 5-gene menthol route
Spearmint	80	C	Hard	a softer cool, no sharp menthol
Ginger	120	P	Moderate	warm pungency; gingerol → shogaol on heating
Pepper (Capsicum)	1,060	all	Native	the designed gentle heat; every axis available
Blueberry	120	A	Moderate	a clean astringent finish for the sweet side
Pomegranate	120	A	Hard	structure and a dry, bright close for drinks
Tea	280	U · B · A	Hard	the three-axis leaf — savory, smooth, structured

How to read the ladder

Three habits turn this inventory into cooking. First, **name the axes the plate needs before you reach** — a morning bowl wants S and K and a touch of C; a dinner broth wants U and K with a low H; a small sweet wants S and B and a thread of A to keep it honest. Second, **reach for the loudest honest source of each**, because loudness is grams saved and a small plate cannot spare grams. Third, **let the synergies do their multiplication** — glutamate with a ribonucleotide, sweetness with kokumi, bitterness attenuated so the sweetness beneath it can finally be heard. Every recipe in Part III is just these three habits applied, and once the ladder is in your hands you will find yourself composing your own small plates on the Index without thinking about it — which is, in the end, exactly what we hoped the number would let you do. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 6 · Sweetness without the sugar — *stevia, monk fruit, and the TAS1R2·R3 lock.*

Sweetness is the axis the changed palate misses most and the one conventional reformulation handles worst. The instinct, when sweet goes flat, is to reach for more sugar — but sugar is the one thing a smaller, more careful appetite is usually trying to spend less of, and piling it on restores bulk and calories without restoring the brightness, because the dullness was never a shortage of sucrose. It was a receptor reading its agonist less clearly, and an unmasked bitter tail stepping into the gap. The fix is not more sweetener. It is a *cleaner, louder* one — a molecule that hits the sweet receptor at a far lower concentration and, just as importantly, says nothing to the bitter receptors on its way past. That is a design problem, and it is one we have spent nine hundred and ten constructs on.



Sugarcane, the plant we learned sweetness from — and then learned to deliver without its sugar load.

The flytrap, and the key that fits it best

Recall the sweet receptor from Chapter 2: TAS1R2·TAS1R3, a heterodimer of two Venus-flytrap domains. Sucrose works by settling into the cleft and closing it, but sucrose is a mediocre key — its EC_{50} at the receptor is high, which is why you need teaspoons of it. The high-potency plant sweeteners are extraordinary keys. The steviol glycosides of stevia — stevioside, and the cleaner rebaudiosides, Reb A and the prized Reb D and Reb M — and the mogrosides of monk fruit, mogroside V chief among them, bind both

the flytrap cleft *and* a second allosteric site on the receptor, which is why their EC_{50} sits two to three hundred times lower than sucrose by weight. On the Index that is an enormous IFI-S, which translates, by the density logic of Chapter 1, into milligrams of sweetener doing the work of grams of sugar. For a kitchen built on eating less and loving it more, this is nearly the ideal case: maximum loudness, minimum mass.

The pathway, drawn

To tune a sweetener cleanly you have to know where it is built, and the steviol glycoside route is one of the most elegant in the plant world — a diterpene backbone dressed in sugars. It begins in the same plastid pathway that makes the plant's own growth hormones: geranylgeranyl diphosphate (GGPP) is cyclized by copalyl diphosphate synthase (CPS) and kaurene synthase (KS) into *ent*-kaurene, then oxidized by *ent*-kaurene oxidase (KO) and *ent*-kaurenoic acid hydroxylase (KAH) to steviol, the faintly bitter diterpene core. Steviol tastes of little until it is glycosylated, and glycosylation is where sweetness and its tail are *both* decided — written by a sequence of UDP-glycosyltransferases. UGT85C2 lays the first glucose; UGT74G1 and UGT91D2 add and branch the rest; UGT76G1 makes the clean branch. Stevioside carries fewer, more exposed sugars and a sharper tail; rebaudioside A carries one more glucose; the prized Reb D and Reb M carry more still, arranged so the molecule reads cleaner, sweeter, and nearly tail-free.

STEP	ENZYME	PRODUCT
cyclization	CPS, KS	*ent*-kaurene
oxidation	KO, KAH	steviol
first glucose	UGT85C2	steviolmonoside
core glycosylation	UGT74G1, UGT91D2	stevioside
the clean branch	UGT76G1	rebaudioside A → D → M

So our intervention is surgical and entirely within the plant's own chemistry: shift the terminal UGT flux toward the clean UGT76G1 branch, raising the Reb D and Reb M fraction and lowering stevioside, so that IFI-S rises and IFI-B — the zero-bitter axis — rises with it. A sweeter sweet and a quieter tail, from the same edit. Monk fruit runs a parallel logic on a triterpene frame: cucurbitadienol synthase builds the core, a suite of cytochrome P450s oxidizes it, and UGTs glycosylate it toward mogroside V, the cleanest high-potency sweetener we grow. In both plants the sweetness and its flaw are set at the very same glycosylation step, which is exactly why a single well-placed intervention can lift the one and cut the other at once.

The tail, and how we cut it

High-potency sweeteners have always carried a flaw the whole food industry knows: a tail. Stevioside in particular finishes with a lingering bitterness and a faint licorice note, because the very molecule that closes the sweet flytrap also, at its concentrations, tickles a handful of the TAS2R bitter receptors. On a healthy palate that tail is a nuisance. On a changed palate, where bitterness has

already stepped forward, it can be disqualifying — the sweetness reads flat and the tail reads loud, the exact inversion of what you want. This is where engineering earns the chapter.

The sweetness of a steviol glycoside and the bitterness of its tail are governed by *which sugars hang off the steviol backbone, and where* — the glycosylation pattern, written by a sequence of UGT glycosyltransferases. Stevioside carries fewer glucose units and a stronger tail; Reb A, Reb D, and Reb M carry more, arranged so the molecule reads cleaner and sweeter with far less bitterness. So we shift the plant's own UGT flux toward the clean rebaudiosides and away from stevioside — raising IFI-S and raising IFI-B, the zero-bitter axis, *at the same time*, because cutting the tail is itself an act of bitterness attenuation. The monk-fruit work runs parallel: tuning the cucurbitadienol-to-mogroside-V route through its CYP450 and UGT steps toward the cleanest, least-lingering mogroside profile. The outcome is a sweetness that arrives bright, peaks clean, and *leaves* — no tail to unmask, nothing for a sensitive palate to catch on.

SWEETENER	RELATIVE SWEETNESS (BY WEIGHT)	TAIL / OFF-NOTE	OUR TUNING
Sucrose (reference)	1×	none, but high mass	—
Stevioside	~150–200×	bitter, licorice	shifted away from
Rebaudioside A	~200×	mild	baseline clean
Rebaudioside D / M	~200–250×	very low	the target profile
Mogroside V (monk fruit)	~250–300×	very low, clean	tuned up

A sweet base to build on

Most of the sweet moments in this book are built from one simple preparation — a clean sweetener in a form you can spoon — so here it is, early, as a building block the dessert and drink chapters will call for.

```
A clean sweet base · makes ~150 ml · keeps 3 weeks refrigerated
—
120 ml water
2 g Reb-clean stevia leaf, finely ground (or 1.5 g monk-fruit extract)
1 vanilla pod, split and scraped (our high-kokumi vanilla)
a pinch of salt
1 strip lemon zest
```

1. Warm the water to just below a simmer — do not boil, which flattens the delicate sweet notes.
2. Whisk in the ground stevia leaf (or monk-fruit extract) until fully dissolved, about one minute.

3. Add the vanilla seeds and scraped pod, the salt, and the lemon zest. Hold off the heat, covered, for ten minutes.
4. Strain. The base should taste bright and clean, sweet with a rounded vanilla middle and no bitter finish. If a tail appears, you have used too much extract — dilute rather than re-sweeten.

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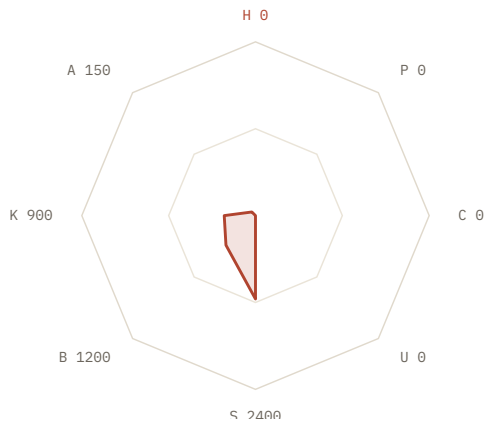


IFI-H	0
IFI-P	0
IFI-C	0
IFI-U	0
IFI-S	2,400
IFI-B	1,200
IFI-K	900
IFI-A	150

The kokumi in that base is not an accident — the vanilla carries IFI-K, and a little continuity under sweetness is what keeps clean sweetness from reading thin, the sugar-free sweetener's other classic failing. Sweetness, kokumi, and zero-bitter, composed together: the sweet side of a changed palate, answered on three axes at once with almost no mass at all. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 7 · The vegetables people finish — *turning the bitter channel down.*

Here is a small tragedy of the changed palate, repeated in kitchens everywhere: the foods a careful eater most wants to lean on — the broccoli, the kale, the dark leaves and crucifers that carry so much nourishment per gram — are precisely the ones that turn bitter and go unfinished. It is not stubbornness and it is not a failure of discipline. It is TAS2R38 and its neighbors reading the glucosinolate load of the Brassica family loud and clear, with less sweet and umami signal left to balance them. The conventional answers are blunt: bury the vegetable in fat and salt, or cook it to death, both of which cost the nourishment you were reaching for. There is a better one, and it begins at the source, in the plant's own chemistry.



A cross-section of our bitterness-tuned broccoli — the glucosinolate load lowered 20 to 65 percent, so the green is finished rather than left.

Where the bitterness is made

The bitterness of a crucifer is not a vague quality; it is a set of specific molecules, the glucosinolates — sinigrin, glucoraphanin, and their kin — stored in the plant's tissue and converted, when the tissue is cut or chewed and the enzyme myrosinase reaches them, into the pungent, bitter isothiocyanates. Those isothiocyanates and the intact glucosinolates together are what light up TAS2R38. The biosynthesis of the aliphatic glucosinolates runs through a well-mapped pathway under the control of a master transcription factor,

MYB28, with the AOP2 and the GSL-series genes shaping the final mix. Turn the pathway's dial down — reduce MYB28 drive, modulate the AOP/GSL steps — and the plant builds a lower glucosinolate load. Less agonist at the bitter receptor, predicted at a 20 to 65 percent attenuation across our constructs, which is the span of the Zero-Bitter axis, IFI-B.

We tune; we do not strip. This is a point of real conviction in the family, and worth stating plainly: the glucosinolates are part of why these vegetables are worth eating, part of their character and their chemistry, and a broccoli with none of them would be a lesser plant and a lesser food. The goal is not a bland green. It is a green whose bitterness sits where a balanced palate can carry it — present enough to taste like itself, quiet enough to finish. Twenty to sixty-five percent is a range, not a maximum, and the cultivars are tuned across it so a cook can choose: a gentle reduction for someone who always loved crucifers and now finds them sharp, a deeper one for the eater who never could abide them.

The regulators

The precision of the bitterness work rests on a fact plant science has mapped in detail: glucosinolate biosynthesis is governed by a small set of transcription factors we can turn like dials. The pathway builds in three acts. First, chain elongation — an amino acid, usually methionine, is extended by a cycle of enzymes (the MAM synthases at its heart) to set the length of the eventual side chain. Second, core structure formation — cytochrome P450s of the CYP79 and CYP83 families, with downstream sulfur chemistry, assemble the conserved glucosinolate core. Third, side-chain modification — the AOP and GSL-OH enzymes decide the final shape, and with it the exact bitterness and pungency. Over the aliphatic branch, the one that governs most of a crucifer's bitter load, sit two master regulators, MYB28 and MYB29; over the indolic branch sits MYB51.

Because the whole pathway answers to these regulators, we can lower a crucifer's bitterness without blunt removal of any single compound: easing MYB28's drive and modulating the AOP step lowers the aliphatic glucosinolate pool across the board — our model predicts — within the 20-to-65-percent attenuation range that defines the IFI-B axis. And because the span is a *dial*, not a switch, we tune cultivars across it — a gentle reduction for a lifelong crucifer-lover who now finds them sharp, a deeper one for the eater who never could abide them. We keep the sulfur chemistry and the character the family is known for; we simply lower the volume of the single loudest off-note so the sweeter, nuttier flavors beneath it can finally be heard. A dial, turned with a light hand, is the whole difference between a vegetable attenuated and a vegetable ruined.

Reading it on the plate

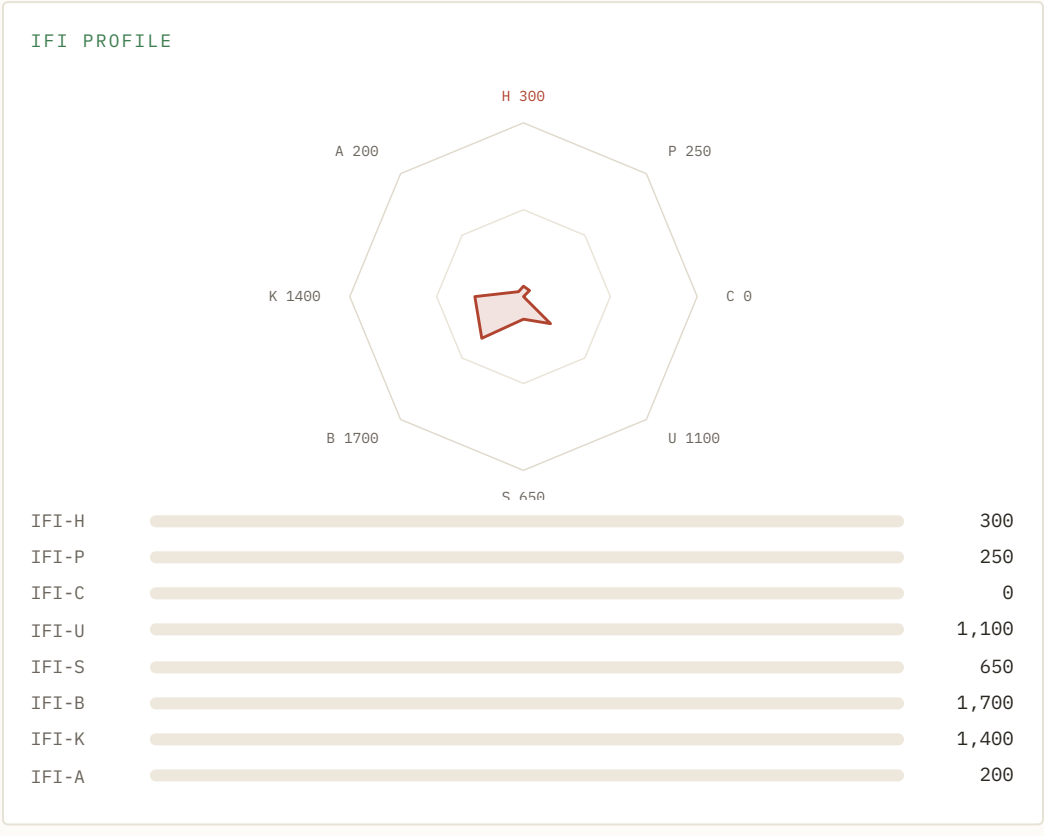
The elegance of the zero-bitter axis is that attenuating bitterness does not only remove something — it *reveals* something. Bitterness masks; lower it, and the sweet, nutty, green flavors underneath that were always there finally come forward. A cook who has only ever tasted conventional kale knows its bitterness as the dominant note;

taste our bitterness-tuned kale beside it and the surprise is not the absence of bitterness but the *presence* of a sweetness and a roundness the bitterness had been hiding. On the Index this shows as a high IFI-B riding alongside a modest IFI-S and IFI-K that were previously inaudible. It is the clearest case in the book of our governing principle that you design a palate's experience, not just a molecule — because the molecule you removed was standing in front of the flavors you wanted.

A finishing green that gets eaten

```
Charred bitterness-tuned broccoli, lemon and kokumi · serves 2 small
plates
—
250 g bitterness-tuned broccoli (SS Brassica line), in small florets
1 tbsp cold-pressed olive oil
2 cloves high-kokumi garlic, thinly sliced
4 g savory yeast flakes
juice and zest of ½ lemon
flaky salt
a scrape of mild designed pepper (optional, for a gentle warmth)
```

1. Get a dry heavy pan very hot. Toss the florets with the oil and a little salt, then lay them cut-side down and leave them undisturbed until deeply charred, about three minutes — the char builds its own sweetness and a faint welcome bitterness that the tuned cultivar keeps from tipping over.
2. Lower the heat, add the sliced garlic, and cook just until it turns gold and fragrant, one minute; the kokumi garlic should perfume the pan without burning.
3. Off the heat, shower with the savory yeast, the lemon juice and zest, and a final pinch of flaky salt. Add the scrape of pepper if you want a thread of warmth to wake the plate.
4. Eat hot, ideally with your fingers, which is how broccoli this good tends to get finished.



Read that scorecard and the strategy is visible in the numbers: the IFI-B at 1,700 is the tuned cultivar doing its quiet work, holding the bitterness where the palate can carry it; the savory yeast and kokumi garlic bring U and K to meet it; and the small S at 650 is the

sweetness the lowered bitterness let out of hiding. A vegetable, in other words, composed on four axes to be a vegetable someone actually finishes. That — not disguise, not drowning it in sauce — is how a functional kitchen gets the nourishment of a crucifer into a body that had learned to leave it on the plate. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 8 · Brightness, cool, and the sharp edge — *waking a flat palate on three axes.*

The savory and sweet axes rebuild the body of a dish; the three we take up now rebuild its *attention*. Cool-burn at TRPM8, pungency at TRPA1, and the clean structure of astringency are the brighteners — the axes that, used in small strokes, wake a flat palate, pull focus to a bite, and give a dish an edge to catch on. A changed appetite is unusually responsive to them, which is a gift to the cook: where a few extra grams of anything heavy risk tipping into too-much, a thread of cool or a scrape of sharp costs almost nothing and turns a dish on. This chapter is about those small strokes, and about one more lever — acid — that is not on our Index at all, and that an honest kitchen has to name anyway.



Ginger in cross-section — the warm sharp edge, where gingerol turns to the deeper shogaol under heat.

Cool without cold

TRPM8 is the receptor that reads menthol, and it is the mirror image of the heat receptor TRPV1: where capsaicin lowers TRPV1's thermal threshold so the body reports a fire that is not there, menthol lowers TRPM8's threshold so the body reports a coolness that is not there. The tissue does not drop in temperature; the receptor simply becomes willing to fire at ordinary mouth warmth, and the brain reads *cool*. For a flat palate this is a small miracle, because coolness reads as freshness and clarity — it lifts the top notes of a dish,

makes a heavy thing feel lighter, and gives a drink a brightness that has nothing to do with sweetness or acid. Our peppermint, the cooling workhorse at 2,360 constructs, carries the five-gene menthol pathway tuned so the cool arrives clean and controllable; our spearmint offers a softer version with far less of the sharp menthol bite, for when you want brightness without the dental-rinse edge. On the Index this is IFI-C, and in this kitchen it is used in strokes — a few torn leaves, a drop of distilled essence — never in floods.

The five-gene cool

The coolness our peppermint carries is menthol, and menthol is the end of a short, beautiful monoterpene pathway — the "five-gene" route the library prizes because it transfers cleanly to plants that never cooled anything. It starts where a plant's terpenes start, with geranyl diphosphate (GPP), which limonene synthase cyclizes into (−)-limonene, the citric top note of the pathway. From there a sequence of tailoring enzymes walks limonene toward menthol: a hydroxylase sets an oxygen on the ring (limonene-3-hydroxylase), an isopiperitenol dehydrogenase and an isopiperitenone reductase reshape it, a pulegone reductase fixes the crucial stereochemistry, and a final menthone reductase delivers (−)-menthol — the single enantiomer that fits TRPM8 best and reads as clean, true cool rather than the muddy, medicinal note its mirror image gives. Control the last reductase steps and you control the balance of menthol against menthone and pulegone, which is the whole difference between a bright cool and a harsh one.

Why cool matters so much to a changed palate returns us to the receptor. TRPM8 is the cold sensor, and menthol works not by chilling the tissue but by shifting the channel's activation threshold warmer, so that ordinary mouth temperature is now read as cold — a coolness reported where none exists, the exact mirror of what capsaicin does at the heat receptor TRPV1. A flat palate reads that false cool as freshness and clarity, a lift on the top of a dish that costs no sweetness, no fat, and almost no mass. This is why a few torn leaves or a single drop of distilled essence can wake a whole bowl, and why we dose it in strokes: the receptor is sensitive, the effect is large, and a small plate wants brightness, not a mouthful of mint. The cool is a wake-up, delivered in micrograms.

The sharp channel

TRPA1 is the sharp receptor, and it works differently from all the others: its agonists are electrophiles that react with cysteine residues inside the channel, a chemistry rather than a fit. Allyl isothiocyanate from mustard and wasabi, cinnamaldehyde from cinnamon, allicin from cut garlic, and the gingerols and shogaols of ginger all light it up, and the sensation — the nose-tingle of wasabi, the warm bite of ginger, the sharp top of raw garlic — is attention itself, a pull toward the dish that a quiet appetite answers to. Ginger is the one we reach for most in this kitchen because its sharpness is *warm* rather than cold, and because it transforms as you cook it: the gingerol of raw ginger, pungent and bright, dehydrates under heat into shogaol, which is sharper still and deeper, so a cook controls

the character of the edge by controlling the heat. On the Index this is IFI-P, and like cool it is a small-stroke axis — a grated teaspoon, a sliced coin in a broth — used to wake, not to dominate.

Structure, and the finish

Astringency is the odd one: not a taste and not quite a sensation of touch, but the dry, puckering tightening that tannins produce when they bind and precipitate the proline-rich proteins that keep saliva slippery. On the Index it is IFI-A, read at those salivary PRPs, and its gift to a dish is *structure* — a clean, dry finish that keeps sweetness from cloying and gives a drink a shape its last sip can hold. Our blueberry and pomegranate carry it bright and fruit-clean; our tea carries it alongside umami and a tuned-down bitterness, the three-axis leaf. In a functional kitchen astringency's main job is to keep the sweet side honest: a thread of it under a dessert or a drink stops the clean sweetener from reading flat and one-note, and gives the whole thing a finish rather than a fade.

The lever we do not own

Acid belongs in this chapter by its effect and nowhere in our Index by its mechanism, and we would rather say so than pretend otherwise. Sourness is read by its own channel — the proton-sensing machinery of the sour taste cells — and it is not an axis we design; a lemon is a lemon, and we grow it, we do not tune it. But acid is perhaps the single most powerful appetite-waker a cook has: a squeeze of lemon, a splash of good vinegar, the brightness that makes the mouth water and pulls a flat palate to attention. We use it constantly and we score it nowhere, and when you see a recipe in this book finished with citrus or vinegar, know that it is doing real work the Index does not claim to measure. Honesty about the edges of our instrument is part of what makes the instrument trustworthy. The eight axes are the flavors we can design. Acid is the one we are grateful simply to grow. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.



PART III OF IV

The Daily Kitchen

mornings · broths · the protein plate · small plates · sweet, kept small · sips

Chapter 9 · Mornings — *protein-forward, gentle on a quiet appetite.*

Morning is the hardest meal for a changed appetite and the most important one to get right. The appetite is often at its most hesitant early, the stomach least willing, and yet this is the meal where a protein-forward start does the most for the whole day's nourishment. The answer is not a big breakfast — a big breakfast on a small appetite is a plate half-returned and a morning begun in defeat — but a *dense* one: a few bites, gentle in texture and bright on the palate, carrying real protein and real flavor in a form the morning body will actually accept. These three are the mornings our family keeps coming back to, built soft, built bright, built to be finished.



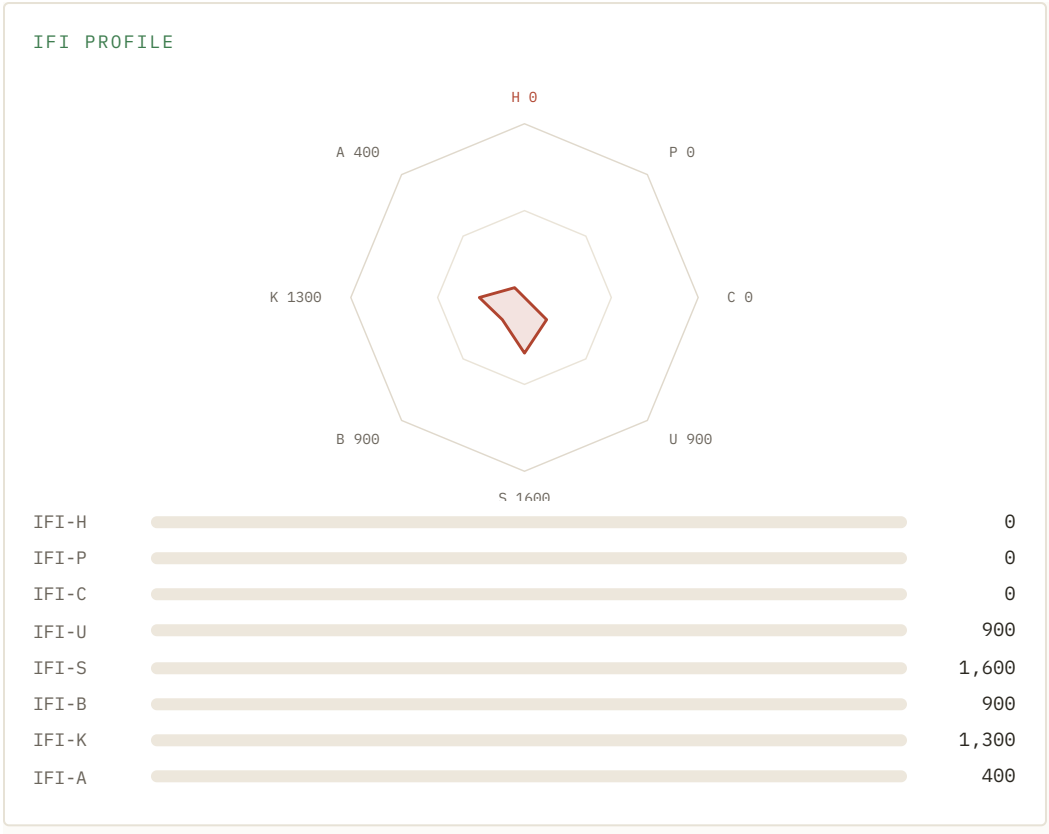
Blueberries — the clean astringent brightener that wakes a morning plate without weight.

Silken tofu, warm, with vanilla and blueberry

A savory-sweet morning bowl built on silken tofu — soft enough for the most hesitant appetite, and quietly one of the most protein-dense gentle foods there is.

```
Serves 1 · ready in 6 minutes
—
150 g silken soft tofu (our high-umami soybean line)
60 ml unsweetened soy milk, warmed
2 tsp clean sweet base (see Chapter 6)
¼ tsp vanilla seeds (high-kokumi vanilla)
40 g bitterness-tuned blueberries
1 tbsp toasted walnuts, chopped
a pinch of flaky salt
```

1. Warm the silken tofu gently — a minute in a covered bowl over simmering water, or thirty seconds at low power — until just heated through. Do not let it boil or it weeps.
2. Whisk the warm soy milk with the clean sweet base and the vanilla seeds until smooth and fragrant.
3. Spoon the warm tofu into a bowl, pour over the vanilla milk, and let it pool.
4. Top with the blueberries, the toasted walnuts, and a pinch of flaky salt — the salt is not optional; it lifts the sweetness and rounds the whole bowl.



The quiet achievement here is the pairing of S and K and U in one soft spoonful: sweetness and continuity from the base and the vanilla, a savory floor from the tofu that most sweet breakfasts never have, and the blueberry's thread of astringency keeping it all honest. A changed appetite finishes this bowl. The body gets its early protein. The day starts won.

Sidebar · Why we char the fruit

When a peach half hits a dry, screaming-hot pan and blackens at the edges, two chemistries fire at once, and both work in the functional kitchen's favor. The first is caramelization — the fruit's own sugars, heated past about 160 °C, fragmenting and recombining into hundreds of new molecules, bitter-edged and deep, that a raw fruit never holds. The second is the Maillard reaction, the cascade between those sugars and the fruit's trace amino acids that builds the roasted, savory-sweet notes we read as "cooked." Neither adds a gram of sugar; both *concentrate and complicate* the sweetness already there, driving off water and leaving the fruit's flavor louder per bite. For a changed palate, char is free density — a way to make a modest piece of fruit taste like more of itself, and to give a flat palate the dark, complex top notes a dulled sweet receptor can still clearly read. We char constantly in this book for exactly that reason: it is the one kitchen technique that raises flavor density with heat alone, no ingredient required.

Whipped high-protein yogurt, cool mint, charred peach

For the morning that wants something cold and bright. Greek yogurt is the protein engine; the cool mint and the char do the waking.

Serves 1 · ready in 8 minutes

—

170 g plain high-protein Greek yogurt
1½ tsp clean sweet base (see Chapter 6)
3 leaves designed spearmint, very finely slivered
1 ripe peach, halved and pitted
¼ tsp olive oil
1 tbsp pistachios, chopped
zest of ¼ lemon

1. Whisk the yogurt with the clean sweet base until it loosens and whips slightly, light and glossy. Fold in the slivered spearmint — the soft cool, not the sharp menthol.
2. Rub the peach halves with the oil and char them cut-side down in a very hot dry pan until blackened and collapsing at the edges, two to three minutes. The char concentrates the fruit's own sweetness.
3. Spoon the cool whipped yogurt into a bowl, set the warm charred peach alongside, and let the temperatures meet.
4. Finish with the pistachios and lemon zest.

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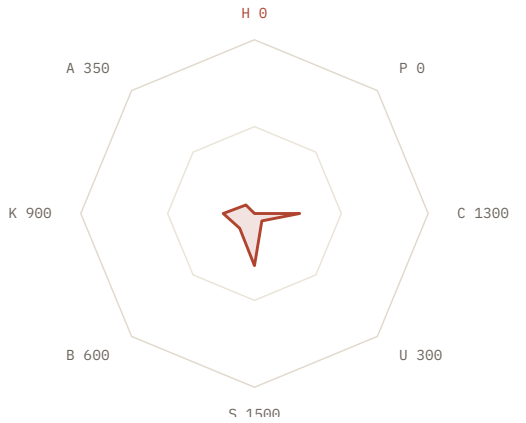


IFI-H	0
IFI-P	0
IFI-C	1,300
IFI-U	300
IFI-S	1,500
IFI-B	600
IFI-K	900
IFI-A	350

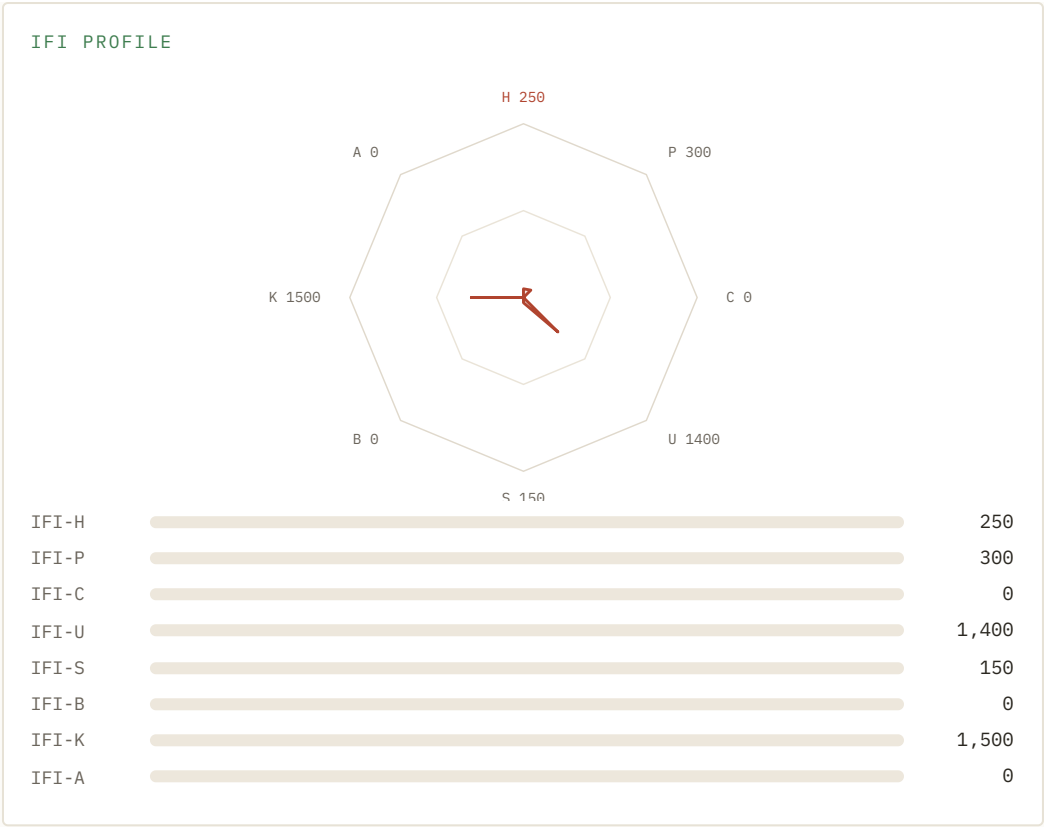
The IFI-C at 1,300 is the whole trick — the spearmint's cool reads as freshness and wakes the morning palate, while the warm-cold contrast with the charred peach gives even a small portion something to pay attention to. This is the brightener axis of Chapter 8 doing exactly what it was described to do, on a plate, before nine in the morning.

Soft scramble, savory yeast, chive

The one egg morning, for when the body wants plain protein and warmth. Eggs are written here with the same respect as everything else — a dense, gentle, complete protein, cooked soft.

```
Serves 1 · ready in 7 minutes
—
2 eggs
1 tbsp unsweetened soy milk
3 g savory yeast flakes (our high-U/K yeast)
½ tsp cold butter or olive oil
1 tbsp chives, finely sliced
1 clove high-kokumi garlic, grated to a paste
flaky salt
a scrape of mild designed pepper
```

1. Beat the eggs with the soy milk, the savory yeast, and the grated garlic until completely smooth — the yeast and garlic put umami and kokumi *into* the egg rather than on top of it.
2. Melt the fat in a nonstick pan over the lowest heat. Pour in the eggs and wait, stirring slowly with a spatula, pushing soft curds and pulling the pan off the heat before they look done — they finish in their own warmth.
3. Fold in most of the chives off the heat, while the curds are still glossy and barely set.
4. Slide onto a warm plate, finish with the rest of the chives, a pinch of flaky salt, and a scrape of pepper.



Two eggs, cooked soft, carrying an IFI-U of 1,400 and an IFI-K of 1,500 that no plain scramble has — the savory yeast and kokumi garlic turn a modest portion into something that tastes like far more than two eggs, which is the entire point of a dense morning. A small plate, finished, protein in the body, the day begun.

Savory cottage cheese, tomato and kokumi dust

The no-cook morning, and quietly the highest protein per gram in the chapter.

Serves 1 · ready in 4 minutes

—

150 g high-protein cottage cheese
1 restored tomato, diced small
1 tsp kokumi dust (Chapter 12)
½ tsp olive oil
a few basil leaves, torn
flaky salt, a scrape of mild designed pepper

1. Spoon the cottage cheese into a bowl and make a shallow well in the center.
2. Dress the diced restored tomato with the olive oil, a pinch of salt, and the torn basil; pile it into the well.
3. Shower the whole bowl with the kokumi dust and a scrape of pepper. Eat cold, with good bread alongside if you want it.

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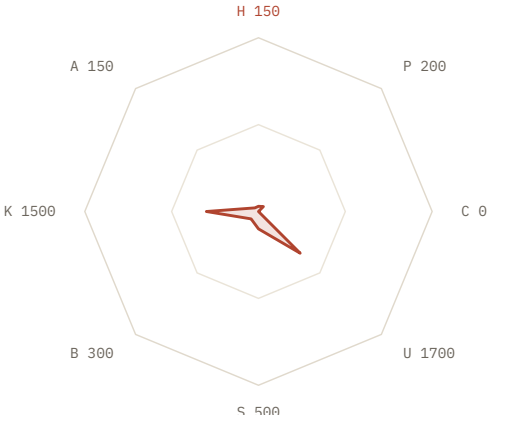


IFI-H	150
IFI-P	200
IFI-C	0
IFI-U	1,700
IFI-S	500
IFI-B	300
IFI-K	1,500
IFI-A	150

No stove, four minutes, and an IFI-U of 1,700 from the restored tomato meeting the kokumi dust — savory depth and continuity on a cold spoon, carrying more protein than any other breakfast here. For the mornings a changed appetite can barely face cooking, this is the one we reach for. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 10 · Broths & brothy bowls — *the kokumi kitchen.*

If this book has a heart, it is here. A broth is the purest expression of everything the functional kitchen is after: almost no mass, almost no calories, and — built right — more satisfaction per spoonful than a plate three times its size. A broth is density in liquid form, and it is the single most reliable friend of a changed appetite, because warm savory liquid is gentle on a hesitant stomach while delivering umami and kokumi in a form the body reads as deeply nourishing. This is the kokumi kitchen of Chapter 4 made practical: broths engineered to fill the long middle of the bite, to sustain their intensity through the swallow and past it, so that a small bowl reaches all the way into the body's sense of enough.



Onion in cross-section — the long slow base note under every broth in this chapter.

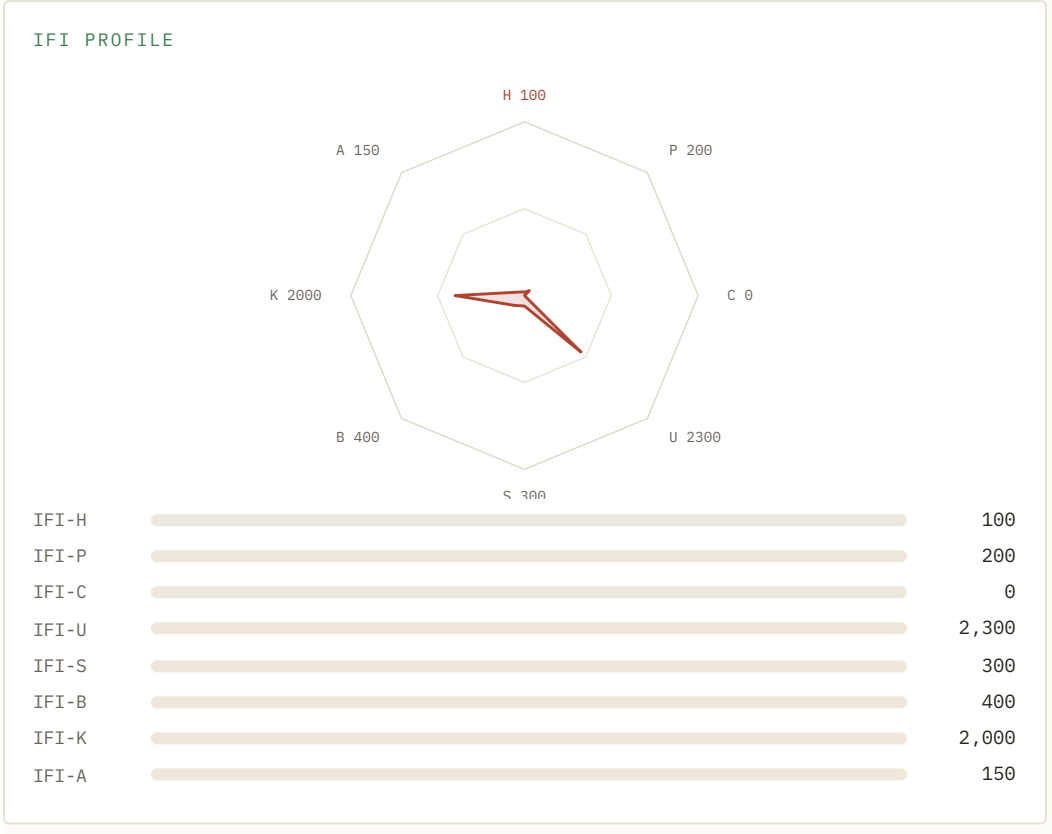
The mother broth — umami and kokumi, built to last

This is the base. Make it, keep it, and half the bowls in this book are a reheat away. It is where the synergy of Chapter 3 and the continuity of Chapter 4 are built in from the start.

```
The mother broth · makes ~1.5 L · keeps 5 days refrigerated, 3 months frozen
—
20 g dried shiitake (the GMP source — do not skip)
1 large onion (high-kokumi line), halved and deeply charred
1 whole head high-kokumi garlic, halved across
a 5 cm piece designed ginger, sliced
2 restored tomatoes, halved
1 sheet kombu (10 cm)
10 g savory yeast flakes
2 tbsp koji paste (shiro koji or our tuned line)
1.8 L water
1 tbsp light soy or tamari
```

1. Char the onion and garlic halves cut-side down in a dry pan until blackened — this is not optional; the char builds the dark sweetness and depth the broth stands on.
2. Combine everything except the koji paste, savory yeast, and soy in the water. Bring slowly to a bare tremble — never a rolling boil, which turns kombu and shiitake bitter and clouds the broth — and hold it there, barely moving, for 45 minutes.
3. Pull the kombu out at 20 minutes; leave the rest for the full time.

4. Strain. While still hot but off the boil, whisk in the koji paste, the savory yeast, and the soy. Taste: it should fill your whole mouth and *stay*, a savoriness that lasts well past the swallow. If it fades, whisk in a little more yeast.



Read that scorecard as the thesis of the chapter: IFI-U at 2,300 from the glutamate-rich tomato and koji meeting the shiitake's GMP — the synergy multiplication, cooked in — and IFI-K at 2,000 from the kokumi garlic, onion, and yeast building the continuity that makes the broth *last*. The two tall numbers, umami and kokumi, side by side: savory depth and the architecture of fullness, in a liquid that weighs almost nothing. This is the bowl a hesitant appetite can always finish, and the base everything below is built on.

Silken tofu and greens in mother broth

The ten-minute dinner. Protein, greens, and the mother broth — the small complete bowl.

> Serves 1 · ready in 10 minutes
> —
> 400 ml mother broth
> 120 g silken tofu (high-umami soybean), in large cubes
> 1 handful bitterness-tuned greens (broccolini, baby kale, or spinach)
> 2 spring onions, sliced
> ½ tsp toasted sesame oil
> a few leaves designed spearmint (optional)
> chili threads of mild designed pepper, to finish

1. Bring the mother broth to a bare simmer. Slip in the silken tofu cubes and warm them through without stirring — three minutes, gentle, so they stay whole.
2. Add the greens for the last minute, just until they collapse and brighten.
3. Pour into a warmed bowl. Finish with the spring onions, a few drops of sesame oil, the optional spearmint for a cool lift, and a pinch of chili threads for a thread of warmth.

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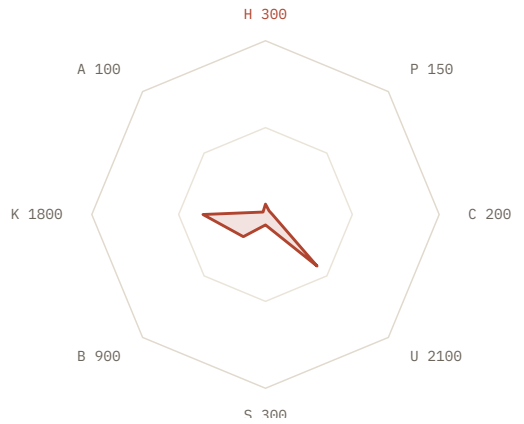

IFI-H	300
IFI-P	150
IFI-C	200
IFI-U	2,100
IFI-S	300
IFI-B	900
IFI-K	1,800
IFI-A	100

Charred corn and tomato brothy bowl

A brighter, sweeter bowl for a warm evening — the restored tomato's sweetness and umami both, in broth.

Serves 2 small bowls · ready in 20 minutes

—

500 ml mother broth
2 restored tomatoes, diced
1 ear of corn, charred and cut from the cob
100 g white beans, cooked
1 clove high-kokumi garlic, grated
a handful basil, torn
juice of ½ lime
flaky salt

1. Char the corn directly over a flame or in a dry pan until spotted black; cut the kernels from the cob.
2. Warm the mother broth with the diced tomato and the grated garlic for five minutes, until the tomato softens and gives up its sweetness.
3. Add the white beans and the charred corn; warm through for three minutes.
4. Off the heat, stir in the torn basil and the lime juice. Taste for salt. Serve in small bowls, the corn and beans giving the broth something gentle to chew.

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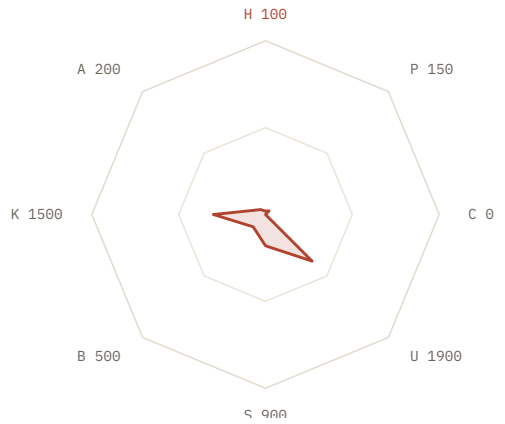

IFI-H		100
IFI-P		150
IFI-C		0
IFI-U		1,900
IFI-S		900
IFI-B		500
IFI-K		1,500
IFI-A		200

The lime at the end is the Chapter 8 lesson again — acid, which we score nowhere, waking the whole bowl and making the restored tomato's sweetness and umami ring. Three bowls, one mother broth, and in every one the same two tall numbers holding the middle of the bite open. A changed appetite is rarely more at ease than in front of a small bowl of broth built this way, and a body rarely better served by so little on the spoon. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 11 · The protein plate — *soy, legume, egg, and the respectful plate of meat and fish.*

This is the center of the daily kitchen: the plate that carries the protein a smaller appetite most needs and most struggles to want. Everything in the first half of this book was, in a sense, preparation for this chapter — the umami that makes a legume taste like a meal, the kokumi that makes a small portion feel like enough, the gentle brighteners that wake a flat palate before a dense food. We are a vegetarian-first kitchen and most of this chapter is plant protein, cooked to be genuinely wanted rather than dutifully tolerated. But a functional kitchen serves real people with real appetites, and the meat and the fish here are written with exactly the same care and exactly the same respect as the tofu — not as a compromise and not with apology, simply as other good proteins, cooked dense and cooked well.



Our high-umami, high-kokumi soybean in detail — the protein this chapter is built to make delicious.

Marinated tempeh, glazed and sharp

The dish that converts the skeptic. Tempeh carries more protein and more texture than tofu, and marinated our way it tastes like the most savory thing on the table.

Serves 2 · ready in 25 minutes plus marinating

—

200 g tempeh (high-U/K soybean), sliced 1 cm thick

—

for the marinade:

2 tbsp koji paste

1 tbsp tamari

1 tbsp rice vinegar

2 cloves high-kokumi garlic, grated

1 tsp grated designed ginger

1 tsp clean sweet base (Chapter 6)

a scrape of mild designed pepper

—

to finish:

1 tsp sesame oil

1 spring onion, slivered

toasted sesame seeds

1. Steam the tempeh slices for ten minutes first — this opens it to the marinade and softens its raw edge. Pat dry.
2. Whisk the marinade. Bathe the warm tempeh in it for at least twenty minutes, or overnight; the koji's enzymes keep deepening the savor the longer it sits.
3. Sear the marinated tempeh in a hot pan with the sesame oil until lacquered and dark on both sides, spooning the remaining marinade over to glaze, three to four minutes.
4. Finish with the slivered spring onion and sesame seeds. Serve small — three or four slices is a full protein portion, and they are rich enough that it is plenty.

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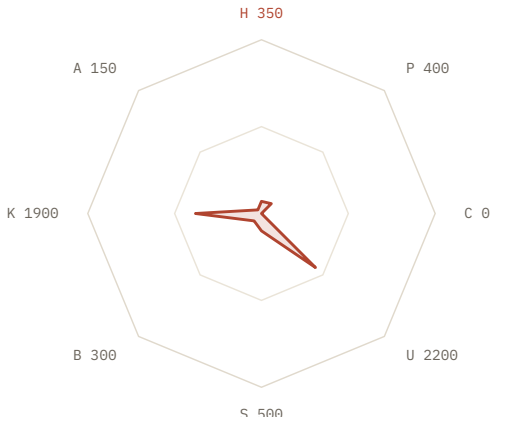

IFI-H	350
IFI-P	400
IFI-C	0
IFI-U	2,200
IFI-S	500
IFI-B	300
IFI-K	1,900
IFI-A	150

That IFI-U of 2,200 and IFI-K of 1,900 on a protein staple is the whole argument of Chapter 3 proven on a plate — the koji and kokumi garlic giving the soybean a savory voice loud enough that a small portion satisfies completely. Watch someone finish this and reach for more; that is density doing what no amount of plain tempeh ever could.

Lentils with charred tomato and savory yeast

A soft-cooked legume plate, gentle on the appetite, deep on the Index.

```
Serves 2 · ready in 35 minutes
—
150 g small dark lentils (beluga or Puy)
2 restored tomatoes, halved and charred
1 onion (high-kokumi), finely diced
2 cloves high-kokumi garlic, minced
1 tbsp olive oil
5 g savory yeast flakes
400 ml mother broth (Chapter 10) or water
1 tbsp sherry vinegar
a handful parsley, chopped
flaky salt
```

1. Soften the diced onion in the oil over low heat until sweet and translucent, eight minutes. Add the garlic for the last minute.
2. Stir in the lentils, then the mother broth, and simmer gently until the lentils are tender but hold their shape, 20 to 25 minutes.
3. Char the tomato halves separately in a hot dry pan until blackened; chop roughly and fold through the cooked lentils with the savory yeast.
4. Finish off the heat with the sherry vinegar and parsley, and salt to taste. The vinegar is the waking acid; do not skip it.

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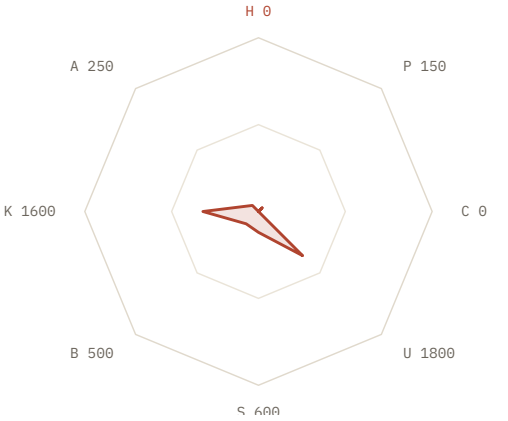

IFI-H	0
IFI-P	150
IFI-C	0
IFI-U	1,800
IFI-S	600
IFI-B	500
IFI-K	1,600
IFI-A	250

Charred chickpeas with koji and greens

A fast, high-protein plate for when the legume needs to be quick.

Serves 2 · ready in 15 minutes

—

250 g cooked chickpeas, drained and patted very dry
1 tbsp olive oil
1 tbsp koji paste
1 clove high-kokumi garlic, grated
1 tsp grated designed ginger
a handful bitterness-tuned greens, shredded
juice of ½ lemon
3 g savory yeast flakes
flaky salt, a scrape of mild designed pepper

1. Get a wide pan very hot. Add the oil and the dry chickpeas and leave them to blister and char, shaking only occasionally, five to six minutes, until crisp at the edges — drying them well is what lets them crackle rather than steam.
2. Lower the heat; add the garlic and ginger for a minute until fragrant, then stir in the koji paste so it coats the chickpeas and caramelizes against the hot pan.
3. Fold in the shredded greens just to wilt, about thirty seconds.
4. Off the heat, finish with the lemon, savory yeast, salt, and pepper. Eat warm, the chickpeas crisp outside and soft within.

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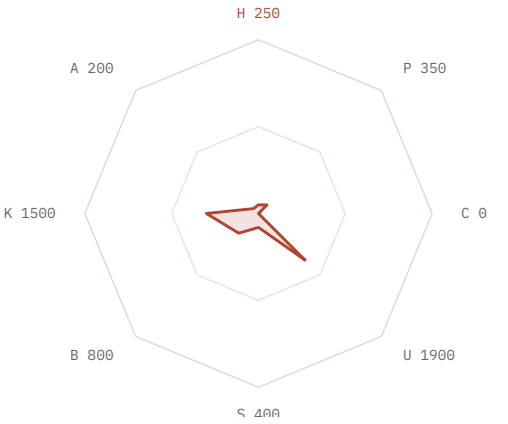

IFI-H	250
IFI-P	350
IFI-C	0
IFI-U	1,900
IFI-S	400
IFI-B	800
IFI-K	1,500
IFI-A	200

The koji is the engine here: its enzymes have already broken the soybean down into free amino acids and ribonucleotides, so a single tablespoon brings both halves of the umami synergy to the pan at once, and the IFI-U lands at 1,900 on a plate that took a quarter of an hour. Crisp, savory, bright with lemon, and genuinely protein-dense — the quick legume dinner a changed appetite finishes.

A respectful plate — seared fish, cool herb, lemon

Written with the same care as the plants beside it. A small fillet, cooked clean, brightened rather than weighted.

Serves 1 · ready in 12 minutes
—
120 g white fish fillet (cod, halibut, or similar), skin on
½ tsp olive oil
flaky salt
—
for the cool herb oil:
1 tbsp olive oil
a few leaves designed spearmint and parsley, finely chopped
zest and juice of ¼ lemon
1 clove high-kokumi garlic, grated to a paste
a scrape of mild designed pepper

1. Stir together the herb oil ingredients and let them sit while you cook, so the garlic and mint infuse the oil.
2. Pat the fish very dry and salt the skin. Lay it skin-side down in a hot pan with the half-teaspoon of oil and press gently for the first thirty seconds so it stays flat. Cook, mostly on the skin side, until all but the top is opaque, three to four minutes, then turn for thirty seconds only.
3. Rest the fillet for a minute on a warm plate.
4. Spoon the cool herb oil over and around. The warm fish and the cool, sharp, lemony oil meet exactly where a quiet appetite wakes up.

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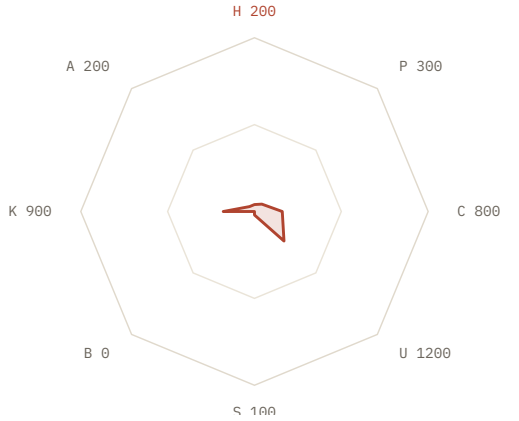


IFI-H	200
IFI-P	300
IFI-C	800
IFI-U	1,200
IFI-S	100
IFI-B	0
IFI-K	900
IFI-A	200

The cool herb oil's IFI-C of 800 is the brightener axis applied to a delicate protein — coolness and the sharp garlic edge pulling attention to a clean, light fillet, so that a small piece of fish eats like a complete plate. Whether the protein on your plate is a legume, an egg, or a fish, the method does not change: find its loudest honest savory voice, build continuity under it, and wake the palate with a small bright stroke at the finish. Density, respect, and a protein portion a changed appetite will actually finish — the center of the

kitchen, held. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 12 · Small plates & snacks — *flavor-dense, hand-sized.*

Between the meals is where a changed appetite most often drifts — the small hungers, the moments the body wants a little something and the kitchen offers only the usual snacks, which are built for a large appetite grazing idly and read as either too much or not worth it. The functional answer is the small plate engineered to be *worth it*: a few dense, bright, protein-carrying bites that answer the small hunger completely and leave nothing half-eaten. These are the things we keep in the kitchen for ourselves — hand-sized, loud on the Index, built so that three bites are genuinely enough.



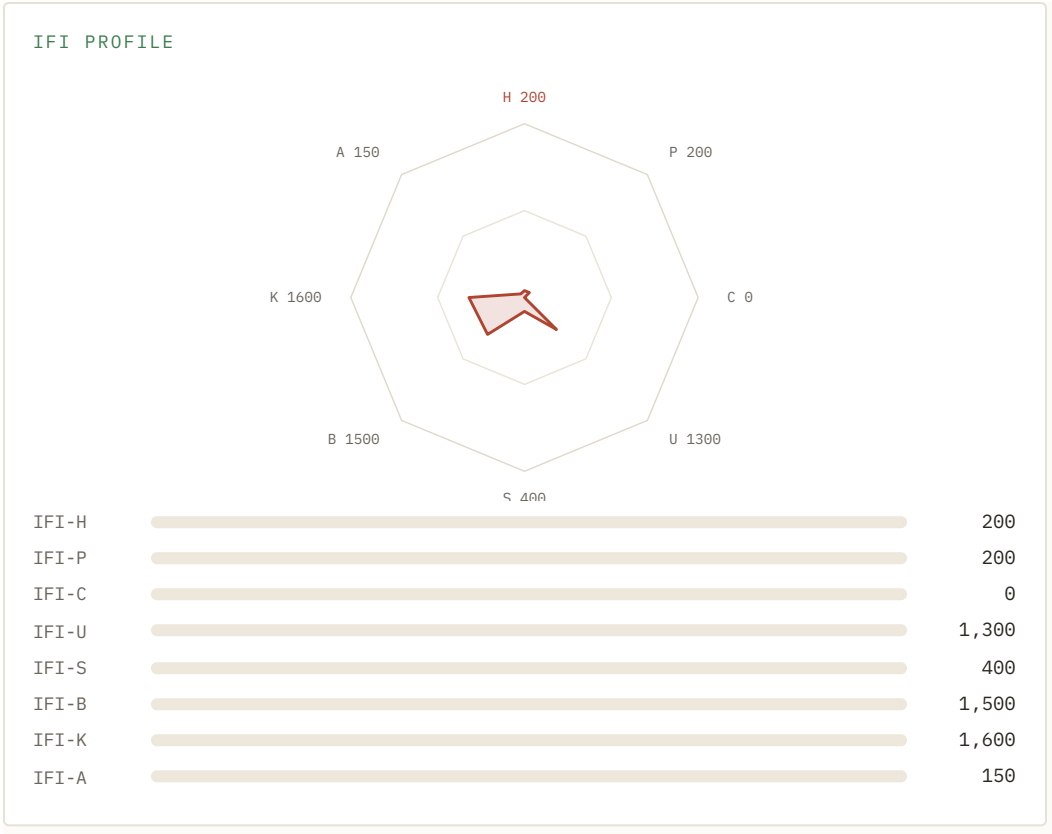
Bitterness-tuned kale — the green that crisps into a snack people finish.

Crisped kale with kokumi dust

The snack that turns a vegetable into something you cannot stop eating — which, with a tuned crucifer, is the whole idea.

```
Makes 2 small bowls · ready in 20 minutes
—
120 g bitterness-tuned kale, stemmed and torn
1 tsp olive oil
—
kokumi dust:
2 tsp savory yeast flakes
1 tsp dried high-kokumi garlic, ground
¼ tsp fine salt
a scrape of mild designed pepper
```

1. Heat the oven to 150 °C. Massage the kale with the oil until every leaf is lightly coated and softened.
2. Spread in a single layer and bake low and slow, 12 to 15 minutes, turning once, until crisp and still deep green — not browned, which turns bitter.
3. Grind the kokumi dust ingredients together fine. The moment the kale comes out, while it is still warm, toss it in the dust so it clings.
4. Eat within the hour, when the crisp is at its best.



Sidebar · The whole umami of a yeast flake

Savory yeast earns its place in nearly every recipe here because it is, uniquely, a *complete* umami package in a single dry ingredient. Deactivated nutritional yeast — the flake, not the live baking kind — is built from cells that ran their metabolism hard in life, and what they leave behind is rich in both halves of the synergy at once: free glutamate from protein turnover, and the 5′-nucleotides, guanylate among them, left over from the machinery of a cell that was constantly building RNA. Recall from Chapter 3 that glutamate and a ribonucleotide together read as their product, not their sum — so a yeast flake is not merely savory, it is *pre-synergized*, carrying its own multiplier inside one ingredient. A teaspoon stirred into eggs, dusted on crisped kale, or whipped into a bean dip delivers an umami loudness far out of proportion to its mass, which is precisely the property a small plate needs. It is the most efficient savory gram in the pantry, and the reason it finishes so many dishes in this book.

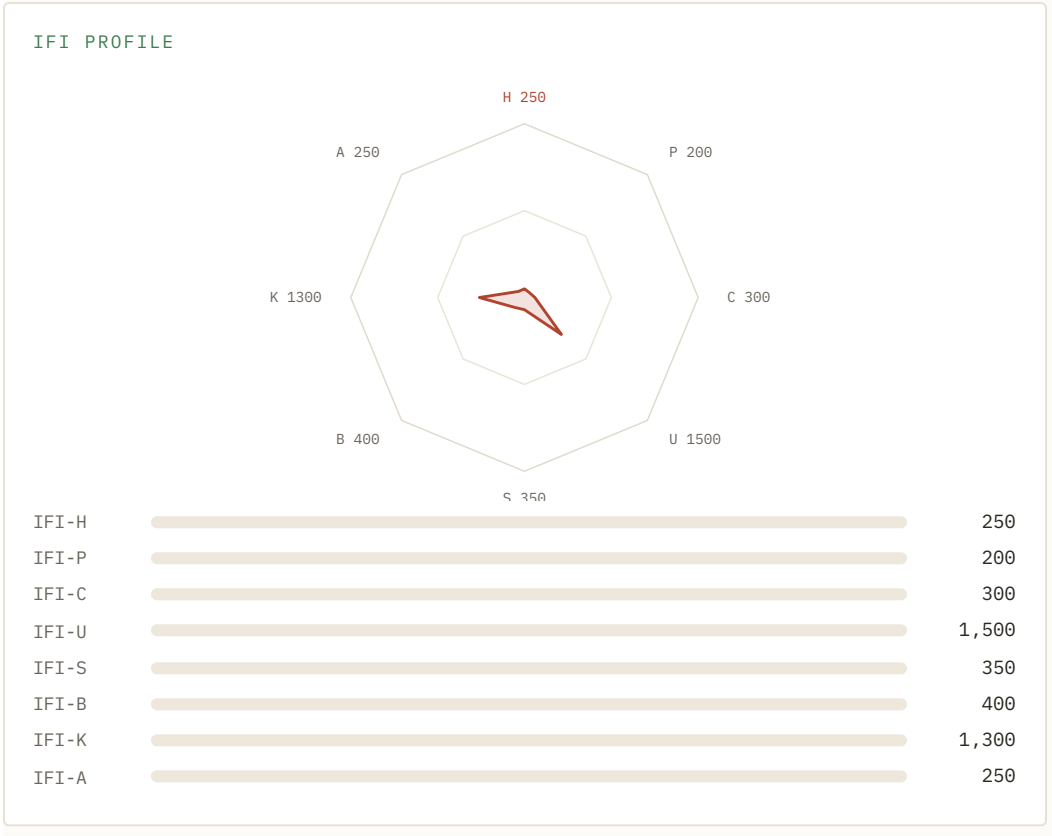
Edamame, smashed, on toast with lemon

Protein you can eat with your hands, bright and green.

```
Serves 2 · ready in 12 minutes
—
150 g shelled edamame (high-U/K soybean)
1 clove high-kokumi garlic, grated
3 g savory yeast flakes
1 tbsp olive oil
zest and juice of ½ lemon
a few leaves mint and basil, torn
flaky salt
2 slices dense wholegrain bread, toasted
a scrape of mild designed pepper
```

1. Steam the edamame three minutes until just tender; reserve a spoonful whole, smash the rest roughly with a fork.
2. Fold the smashed edamame with the garlic, savory yeast, olive oil, lemon zest and juice, and the torn herbs. Salt to taste — it should be bright and savory at once.
3. Pile onto the warm toast, top with the reserved whole beans and a scrape of pepper.

4. Eat immediately, while the toast holds its crunch.



Whipped kokumi white-bean dip

Keep this in the fridge; it rescues a hundred small hungers.

```
Makes ~300 g · keeps 4 days
—
250 g cooked white beans
2 cloves high-kokumi garlic, grated
4 g savory yeast flakes
2 tbsp olive oil
juice of ½ lemon
2 tbsp mother broth or water, to loosen
flaky salt
a scrape of mild designed pepper
```

1. Blend the beans, garlic, savory yeast, oil, and lemon juice until completely smooth, loosening with the broth until it whips light.
2. Season with salt and pepper; it should taste savory, rich, and bright all at once.
3. Serve with crudités of bitterness-tuned vegetables, or spread thick on toast.

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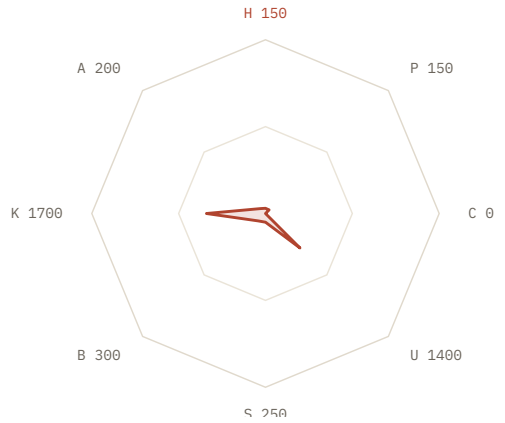


IFI-H	150
IFI-P	150
IFI-C	0
IFI-U	1,400
IFI-S	250
IFI-B	300
IFI-K	1,700
IFI-A	200

Three small plates, each built to the same spec — a savory floor in the thousands, a kokumi number beside it to make the few bites feel complete, a bright acid stroke to wake them. The small hunger, answered in a form that satisfies and then stops, rather than one that grazes on without end. For a changed appetite, having these ready is a kind of quiet insurance: the little hungers meet something worth eating, and the body gets protein and nourishment in the in-between hours it would otherwise spend unfed or over-grazed. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 13 · Sweet, kept small — *dessert at portion.*

Dessert and the changed palate have a complicated relationship. Sweetness dulls, as Chapter 2 described, so the old desserts can read as flat and heavy; and yet the wish for something sweet to end on does not leave, and denying it entirely is its own kind of poverty. The functional kitchen's answer is not to abolish dessert but to rebuild it on the clean, loud sweetness of Chapter 6 — sweetness without the sugar load, kept honest by kokumi and a thread of astringency, and kept *small*, a few perfect bites rather than a slab. A changed appetite does not want a large dessert. It wants a true one. These are built to be exactly that.



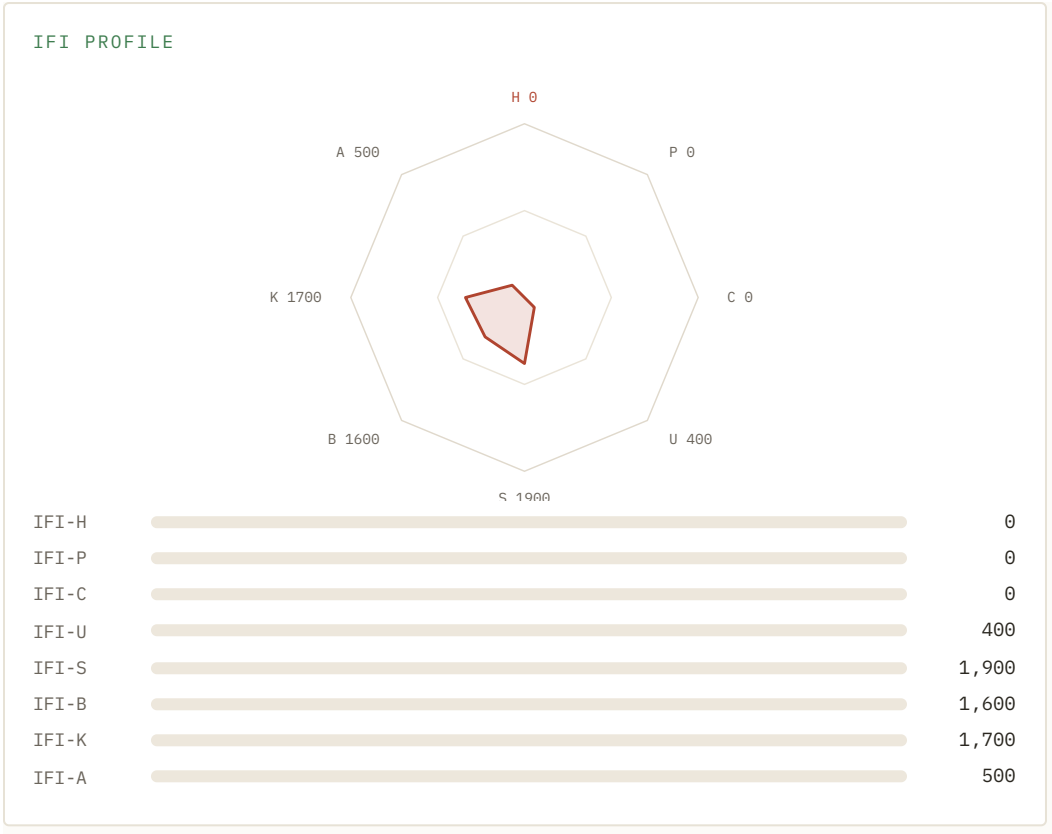
Cocoa in cross-section — bitterness and tannin balanced, the fine-chocolate chemistry behind a dessert kept small.

Dark chocolate and olive-oil mousse

Fine chocolate, its bitterness tuned so the cocoa's depth comes forward clean, whipped light so a few spoonfuls are a whole dessert.

```
Serves 4 small cups · ready in 15 minutes plus chilling
—
80 g fine dark chocolate (bitterness-balanced cocoa line, 70%)
2 tbsp good olive oil
120 g silken tofu (high-U/K soybean), at room temperature
2 tbsp clean sweet base (Chapter 6)
¼ tsp vanilla seeds (high-kokumi vanilla)
a pinch of flaky salt
cocoa nibs and blueberries, to finish
```

1. Melt the chocolate gently with the olive oil over barely simmering water, stirring until glossy. Cool slightly.
2. Blend the silken tofu with the clean sweet base and vanilla until completely smooth and airy — a full two minutes; this is what makes it mousse rather than ganache.
3. With the blender running, stream in the warm chocolate-oil until the mousse thickens and gleams. Blend in the salt.
4. Spoon into four small cups and chill at least an hour. Finish each with a few cocoa nibs and a blueberry or two for a bright astringent edge.



The scorecard tells the dessert's secret: the IFI-B at 1,600 is the tuned cocoa, its harsh bitterness lowered so the chocolate reads as deep and round rather than sharp; the IFI-K at 1,700 from the tofu and vanilla gives it the luxurious continuity of a mousse made with cream it does not contain; and the blueberries' astringency at the finish keeps the sweetness from cloying. Protein, from the tofu, hiding inside dessert. A few small cups, and the sweet wish answered honestly. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Sidebar · Mousse without cream

The chocolate mousse holds its airy, luxurious body with no cream at all, and the reason is protein architecture. Silken tofu is a soft gel of soy protein suspended in water; blended hard, that protein unfolds and re-links around the tiny air bubbles the blade beats in, building a stable foam the same way egg white or cream would — a network of protein holding air and fat in a smooth suspension. The melted chocolate and olive oil, streamed in warm, are caught in that network and set as it cools, giving the richness and gloss of a classic ganache-based mousse. What the tofu adds that cream cannot is protein itself, folded invisibly into a dessert, and a kokumi-carrying continuity from the soybean's own γ-glutamyl peptides. It is the clearest dessert example of the book's whole method: the structure that used to require fat and sugar, rebuilt from a protein that is quietly nourishing, so that a few small cups of genuine mousse carry grams the body can use.

Vanilla-poached pear, cool mint

Barely a recipe, almost all fruit — the gentlest sweet, bright with cool.

Serves 2 · ready in 25 minutes
—
2 firm ripe pears, peeled, halved, cored
300 ml water
3 tbsp clean sweet base (Chapter 6)
1 vanilla pod, split (high-kokumi vanilla)
1 strip lemon zest
a few leaves designed spearmint, to finish
1 tbsp toasted hazelnuts, chopped

1. Bring the water, clean sweet base, split vanilla pod, and lemon zest to a bare simmer.
2. Slip in the pear halves and poach gently, turning once, until just tender to a knife, 15 to 20 minutes depending on ripeness.
3. Let the pears cool in their liquid — they keep drinking in the vanilla as they cool.
4. Serve with a little of the poaching liquid reduced to a syrup, the toasted hazelnuts, and a few slivers of cool spearmint.

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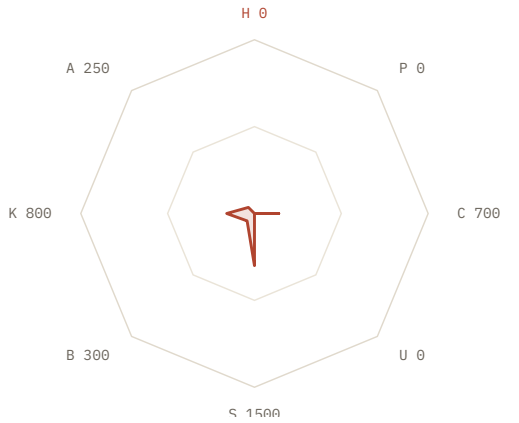

IFI-H	0
IFI-P	0
IFI-C	700
IFI-U	0
IFI-S	1,500
IFI-B	300
IFI-K	800
IFI-A	250

Two-bite chocolate-dipped strawberries, salt and chili

The simplest thing in the book, and the one people reach for first. A whisper of heat is the surprise.

Makes 10 · ready in 15 minutes
—
10 ripe strawberries
60 g fine dark chocolate (bitterness-balanced cocoa)
flaky salt
a scrape of mild designed pepper

1. Melt the chocolate gently. Holding each strawberry by its leaves, dip to half-coat and set on parchment.
2. While the chocolate is still wet, touch each with a few flakes of salt and the barest scrape of designed pepper — enough to warm, not to burn.
3. Let set at room temperature. Eat the same day, two bites each, the heat arriving a beat after the sweet.

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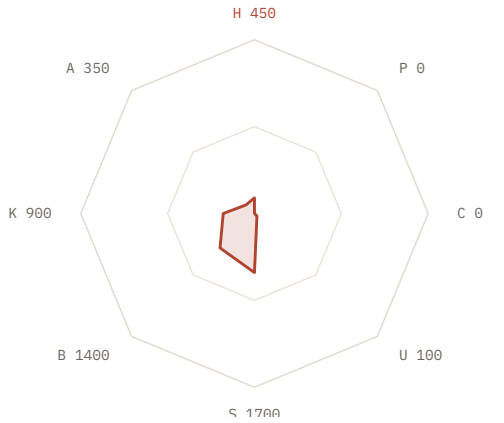
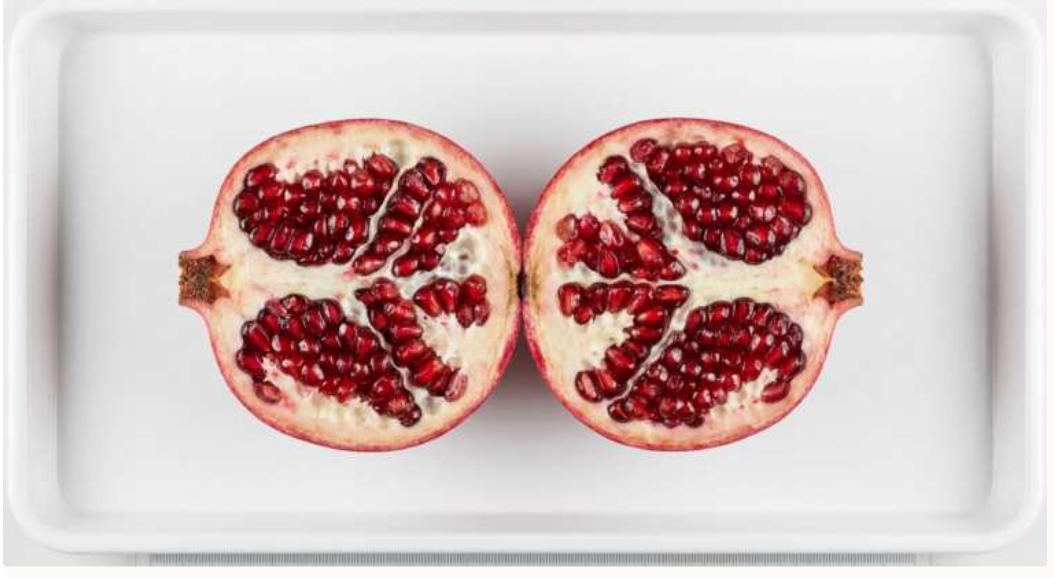


IFI-H	450
IFI-P	0
IFI-C	0
IFI-U	100
IFI-S	1,700
IFI-B	1,400
IFI-K	900
IFI-A	350

That small IFI-H of 450 is the entire point — a gentle designed heat, dosed to a whisper, arriving a beat after the sweetness and the chocolate's tuned bitterness, waking the palate right at the end so the two-bite dessert lingers far longer than its size. Sweet, kept small, kept honest, and ended on a thread of warmth: dessert for a changed appetite, which turns out to be dessert anyone would want.

Chapter 14 · Sips — *cooling, bitter-balanced, bright.*

A changed appetite often shows up first as a changed thirst. Water can taste flat, coffee can turn to pure bitterness, and the sweet drinks that used to be easy now read as cloying. Hydration matters more than ever on a smaller intake and gets quietly harder, so the functional kitchen takes its drinks as seriously as its plates — building sips that are bright enough to want, clean enough to finish, and balanced across the cooling, bitter, and astringent axes that make a liquid feel alive on the tongue. None of these is sweet-heavy; all of them are built to refresh a palate that has gone a little flat and to make the simple act of drinking a pleasure again.



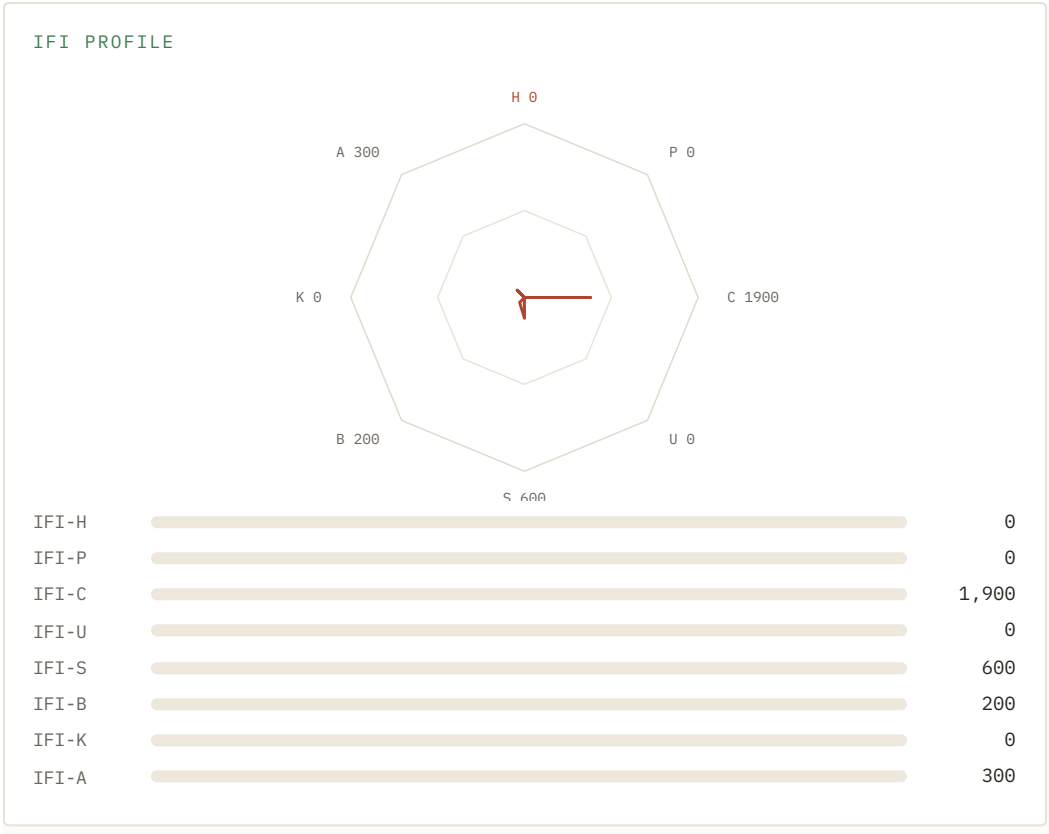
Pomegranate in cross-section — the clean astringent structure that gives a drink its finish.

Cold-steeped mint and cucumber tonic

The everyday glass — cooling, barely sweet, endlessly drinkable.

```
Makes 1 L · ready in 10 minutes plus steeping
—
1 L cold water
a handful designed peppermint and spearmint leaves, lightly bruised
½ cucumber, sliced
1 strip lime zest and the juice of 1 lime
2 tsp clean sweet base (Chapter 6), or to taste
a pinch of salt
```

1. Combine everything in a jug and refrigerate at least two hours, or overnight — cold steeping keeps the mint bright and avoids the stewed note hot water gives it.
2. Taste and adjust: it should be cooling and clean, just barely sweet, with the salt rounding it.
3. Strain over ice. The cooling here is real — the menthol at TRPM8 — and it makes plain hydration something the palate actively wants.



Sidebar · Why cold steeping is kinder

The mint tonic and the green tea cooler are both cold-steeped, and that is chemistry, not fashion. Extraction from a leaf is temperature-driven and *selective*: the bitter and astringent compounds — the catechins and tannins of tea, the caffeine, the harsher volatiles of mint — are larger, less soluble molecules that come out fast and freely in hot water, while the sweeter, brighter, more delicate notes extract gently. Drop the water temperature and lengthen the time, and the balance shifts — far less of the bitter, astringent fraction crosses into the water, and the clean top notes are left to dominate. A cold-steeped green tea can carry most of its umami and aromatic character with a fraction of the bitterness the same leaf gives to boiling water, which for a palate where bitterness has stepped forward is not merely refreshing but actively corrective. Time, in the cold, does the work that heat would do too bluntly. It is the simplest bitterness-attenuation tool in the book, and it needs no engineering at all — only patience and a cold shelf.

The rounded cup — bitterness-tuned iced coffee

Coffee a changed palate can love again, its harsh edge lowered so the warmth underneath comes through.

```
Serves 1 · ready in 5 minutes (with cold brew ready)
—
180 ml cold brew from bitterness-tuned coffee
60 ml unsweetened soy milk
1 tsp clean sweet base (Chapter 6)
¼ tsp vanilla seeds (high-kokumi vanilla)
a pinch of salt
ice
```

1. Stir the clean sweet base, vanilla, and salt into the cold brew until dissolved.
2. Pour over ice and float the soy milk on top.
3. The tuned coffee's lowered bitterness means almost no sweetener is needed — a teaspoon, where a conventional iced coffee hides four — and the vanilla's kokumi gives it a body that reads like far more milk than it contains.

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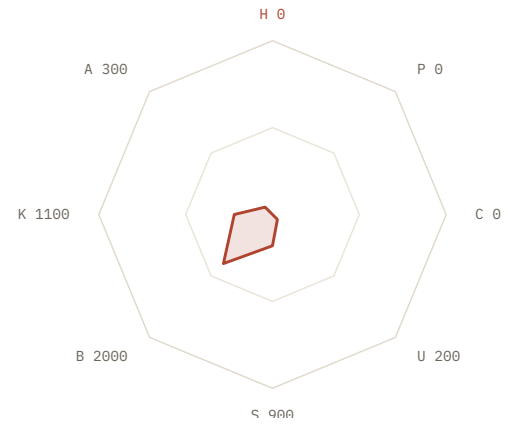

IFI-H	0
IFI-P	0
IFI-C	0
IFI-U	200
IFI-S	900
IFI-B	2,000
IFI-K	1,100
IFI-A	300

The IFI-B of 2,000 is the chapter's clearest demonstration: bitterness attenuation turning coffee from a drink a flat palate rejects into one it welcomes, with a teaspoon of clean sweetener where cups like this usually hide a spoonful of sugar. The Zero-Bitter axis, in a glass, doing exactly what it was designed to do.

Pomegranate and tea cooler

Bright, structured, barely sweet — the drink that finishes clean and makes you want the next sip.

```
Serves 2 · ready in 10 minutes plus chilling
—
400 ml brewed green tea (our U/B/A tea line), cooled
60 ml pomegranate juice (designed astringent line)
juice of ½ lemon
2 tsp clean sweet base (Chapter 6)
a few leaves designed spearmint
ice
```

1. Brew the green tea gently — 75 °C water, three minutes — so its umami and smoothness come through and its bitterness stays low; our tea line is tuned for exactly this.
2. Stir in the pomegranate juice, lemon, and clean sweet base. Chill.
3. Serve over ice with spearmint. The astringency gives it a dry, clean finish that keeps every sip from cloying and pulls you back for the next.

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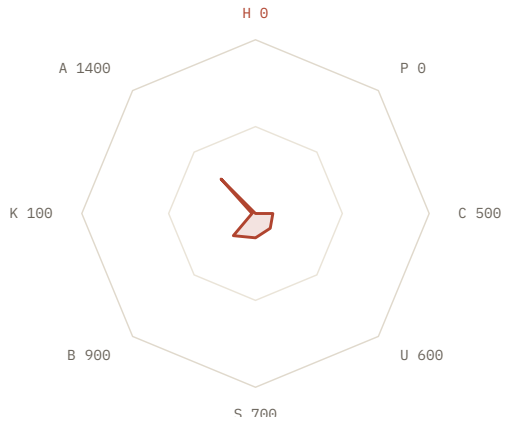
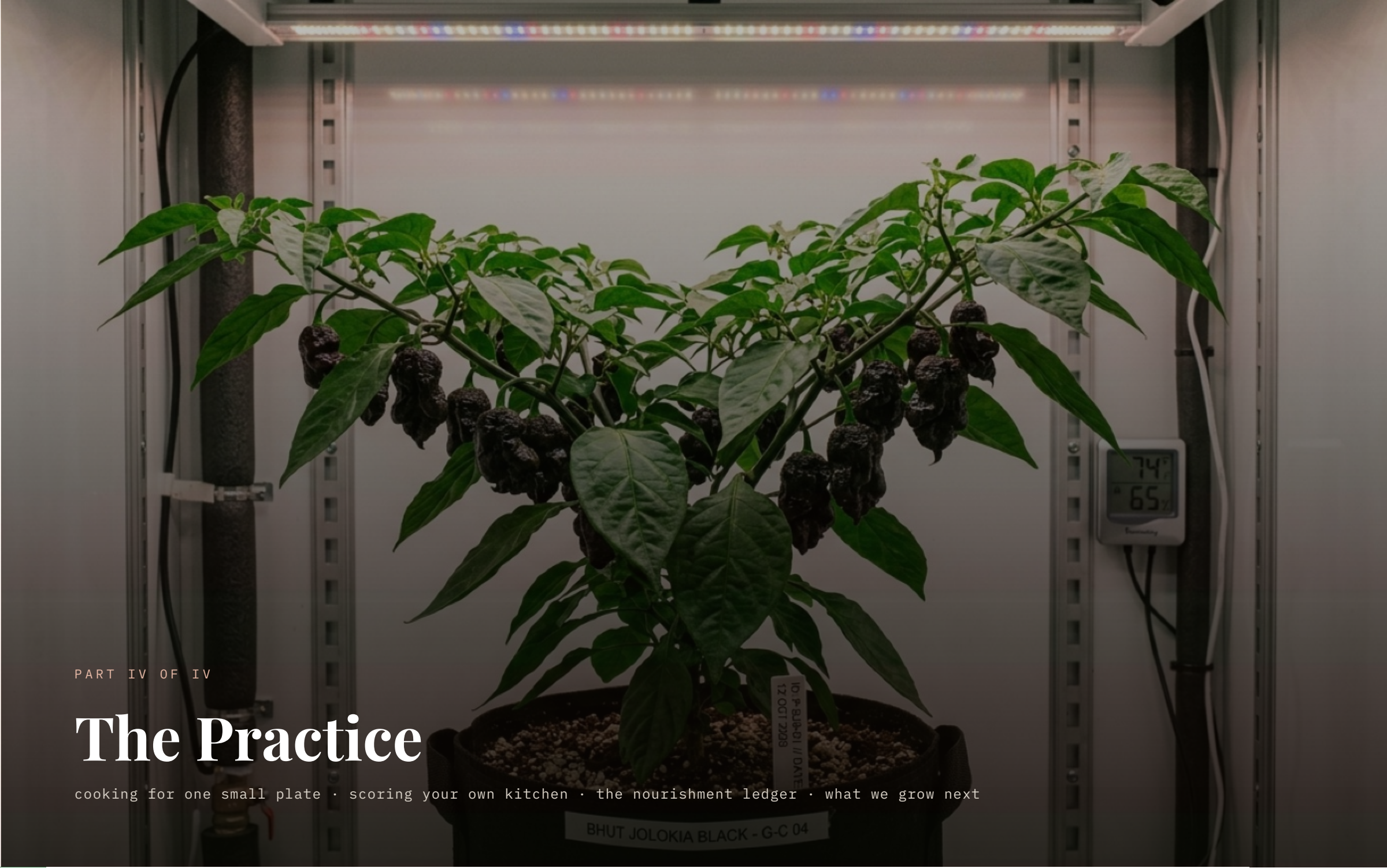


IFI-H	0
IFI-P	0
IFI-C	500
IFI-U	600
IFI-S	700
IFI-B	900
IFI-K	100
IFI-A	1,400

The IFI-A of 1,400 is astringency as structure — the tannins giving the cooler a dry, bright finish that a sweet drink never has, so that even at this gentle sweetness the glass feels complete and composed. Cooling, bitter-balanced, bright: three sips built across the brightener axes, each one a reason to drink, which for a smaller appetite is a quietly important thing. A body kept hydrated and a palate kept awake, one glass at a time. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.



PART IV OF IV

The Practice

cooking for one small plate · scoring your own kitchen · the nourishment ledger · what we grow next

Chapter 15 · Cooking for one small plate — *scaling, batching, and the single serving.*

The recipes in Part III are written small on purpose, and that is harder to cook than it sounds. A kitchen built for a large appetite assumes abundance — big pots, generous pans, the comfortable margin of making plenty — and cooking for one small plate, night after night, needs a different practice: one that makes a few dense bites without a mountain of effort or a fridge of waste, and that treats the single serving not as a sad fraction of a real meal but as the real meal, composed with full care. This chapter is the method that makes the rest sustainable, because a functional kitchen that is exhausting to run is one you will abandon, and the point is to keep it for good.



Measurement is the habit that makes a small kitchen work — the single serving, composed with full care.

Build bases, assemble plates

The single most important move in a small kitchen is to separate the *base* from the *plate*. The bases — the mother broth of Chapter 10, the clean sweet base of Chapter 6, the kokumi dust and the white-bean dip of Chapter 12 — take an hour once a week and keep for days. Each is dense, loud, and designed to be the labor-carrying part of a meal. The plate, then, is a five-minute assembly: warm a portion of base, add a fresh protein and a bright finish, and a complete small meal appears without a night's cooking behind it.

This is exactly how we cook the library itself — build the loud component once, render it many ways — and it is how a changed appetite eats well on a Tuesday without a project.

BASE	TIME TO MAKE	KEEPS	PLATES IT BUILDS
Mother broth	1 hour	5 days / 3 mo frozen	every bowl in Ch. 10, the lentils in Ch. 11
Clean sweet base	15 min	3 weeks	all of Ch. 13, the sips in Ch. 14
Kokumi dust	5 min	1 month	snacks, eggs, any vegetable
White-bean dip	10 min	4 days	small plates, toast, crudité

Scaling by loudness, not by volume

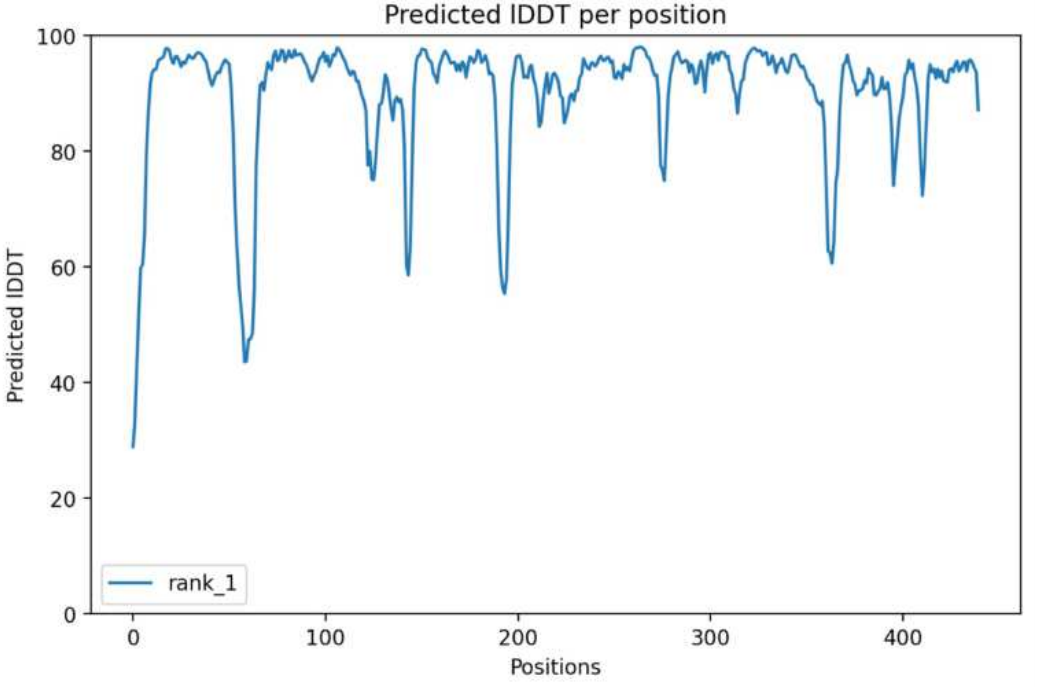
Here is where the Index changes how you scale down. The instinct, halving a recipe, is to halve everything — but the loud designed ingredients do not scale like the quiet ones. A gentle designed heat, a clean high-potency sweetener, a scrape of pungent ginger: these are already dosed near the bottom of what registers, and halving them can drop a dish below the threshold where the axis speaks at all. The rule we cook by is to **scale the mass ingredients down freely and the loud ingredients cautiously** — keep the savory, keep the bright strokes close to full even in a single serving, because the receptor does not care how small your plate is, only what concentration reaches it. A half-sized bowl needs nearly a full measure of savory yeast and a full whisper of pepper to taste like itself. Density is a concentration, not a quantity, and a small plate holds its loudness only if you let it.

The measured hand

The last habit is simply to measure the loud things. A changed appetite rewards precision, because the margin between *bright and awake* and *flat* or *too much* is narrow when the portion is small and the ingredients are loud. We keep a small scale and a set of fine measures by the stove and weigh the designed ingredients in grams — two grams of ground stevia, not a vague pinch; a tenth-gram scrape of pepper, not a shake. This is not fussiness. It is the kitchen version of the ≤7% batch consistency we hold in the greenhouse: the same respect for the number, carried from the lab to the stove, so that the small plate comes out right every time. Cook this way for a week and the measuring becomes instinct, and the single serving stops being a compromise and becomes what it should have been all along — a complete, composed, dense small meal, made with no more effort than it deserves and no more food than you want. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 16 · Score your own cooking — *the index as a kitchen tool.*

We built the Iyengar Flavor Index to design flavor in a greenhouse, but its best second life is as a tool in your own kitchen — a way to read what you are cooking, diagnose what a dish is missing, and compose a small plate on purpose rather than by hope. This chapter hands you the instrument. You will not be measuring EC_{50} at a lab bench; you will be learning to estimate where a dish sits on each axis and, more usefully, to read the *shape* of a scorecard and know what to do next. By the end you should be able to look at any plate — ours or your own — and see it as eight numbers, which is the same as seeing exactly how it will taste and where it falls short.



The method, made visible — the pLDDT confidence map of the Pun1/AT3 model, the kind of molecular reading that anchors every number in this book.

The scorecard as a shape

Read an `ifi` block not as eight separate numbers but as a silhouette — a shape with tall peaks and quiet valleys that tells you at a glance what kind of dish it is. The mother broth's shape is two towers, U and K, with everything else low: that is the silhouette of *savory depth with continuity*, the shape of satisfaction. The sweet base is a single S peak with a B and K shoulder: *clean sweetness, held honest*. The

two-bite strawberry has an S peak with a small, deliberate H spike at the end: *sweetness, woken*. Once you see dishes as shapes, you can diagnose them. A dish that tastes flat almost always has a scorecard that is all one modest height — no peak to grab attention. A dish that tastes thin has a peak but no K beside it — flavor that arrives and falls away. A dish that tastes harsh has a B that is too low, bitterness uncovered. The fix, in every case, is to raise the axis the shape is missing.

Estimating an axis without a lab

You cannot measure EC_{50} at home, but you can estimate IFI with a reliable rough method, because the Index is anchored to perception. Taste a reference you know — the mother broth at IFI-U 2,300 is a good savory anchor, the clean sweet base at IFI-S 2,400 a good sweet one — and rank your dish against it. If your soup is about as savory as the mother broth, its IFI-U is near 2,300; if it is half as loud, call it 1,100. This is the same logic the Index runs on at the bench, where every candidate is read against a fixed reference; you are simply using your own calibrated tongue as the instrument and a known dish as the reference. It is rougher than a plate reader and entirely good enough to cook by. The number you want is never precise; it is *directional* — loud enough, or not loud enough, and which way to move.

Reading synergy and composition

Two dishes can carry the same eight numbers and taste different, and the Index, read carefully, tells you why: the axes do not simply add. The clearest case is the umami synergy of Chapter 3 — glutamate and a ribonucleotide together read as their *product*, not their sum, so a scorecard showing a tall U built from both sources is louder in the mouth than the same U built from glutamate alone. When you score your own cooking, note not just the height of an axis but its *source*, because a cook who stirs a few grams of dried shiitake into a glutamate-rich broth moves the U number far more than the added mass would suggest, riding the multiplication for free. The ribonucleotide is the cheapest loudness in the kitchen precisely because it is a multiplier, not an addend.

The other composition rule is suppression, and it runs the opposite way: strong sweet, umami, and kokumi signals *lower* the brain's read of bitterness, through the shared cascade of Chapter 2. A dish's effective bitterness is therefore not its raw bitter content but its bitter content minus what the other axes are covering — which is why attenuating bitterness at the source (a high IFI-B) and building a floor of umami and kokumi beneath it are two routes to the same finished taste, and why doing both at once lets you use less of each. Read a scorecard, then, as a composition and not a list: ask where the tall axis is sourced, what the other axes are covering or amplifying, and whether a small addition on one axis will move another for free. That is the difference between following a recipe and composing one, and it is the last thing the Index has to teach a kitchen — that flavor is not

eight separate measurements but one integrated whole, and the numbers are how you learn to hear the whole before it ever reaches the tongue.

The Hill curve, as a cook's intuition

One piece of the mathematics is worth carrying in your hands rather than your head. The receptor's response to concentration is the sigmoid of Chapter 1 — flat at the bottom, steep in the middle, flat again at the top:

$$\theta = c^{n} / (EC_{50}^{n} + c^{n})$$

What this means for a cook is that **there is a threshold below which more does almost nothing, a middle where a little more does a lot, and a ceiling above which more is wasted**. Most mistakes in a small kitchen are living at the wrong end of that curve. Under-seasoning sits below the threshold — you have added a sweetener or a savory note but not enough to climb onto the steep part, so it reads as nothing and you wrongly conclude the ingredient is weak. Over-seasoning sits above the ceiling — you have pushed past saturation, wasting mass and often unmasking an off-note, on a changed palate the worst outcome. The loud designed ingredients earn their place precisely here: because their EC_{50} is low, a tiny mass lands you in the middle of the curve where the action is, and a small plate can reach full intensity without ever approaching the ceiling. Cook by the curve — add until the axis climbs, stop when it stops climbing — and you are using, by feel, the exact mathematics we use by measurement. The Index was always meant to end up here, in your hands, at your stove. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.

Chapter 17 · The nourishment ledger — *density per bite, and the road ahead.*

We come, at the last, to the value that has hummed under every page of this book without once being spoken as a promise: that food should be able to give the body the most it can hold, inside the smallest, truest portion you actually want to eat. It is time to say it plainly, and to say just as plainly where its limits are. This is a book about flavor and about nourishment as an *intention* — a way of cooking, a set of attributes we design into food on purpose. It is not a book of health claims, and nothing in it is medical advice. We are cooks and plant scientists, not clinicians; the medicine is between you and your doctor, and we make no claim that any food here changes what it does. What we claim is narrower, truer, and entirely ours to claim: that we can make a small plate carry more.



What we grow next — the field where the roadmap beyond this kitchen is already taking root.

The ledger, honestly kept

Think of a small appetite as a tight budget — fewer bites to spend, and every one has to earn its place. The nourishment ledger is just that accounting done on purpose: what does each bite deliver, and is it the most it could? The whole book has been a method for improving the ledger without enlarging the plate. Density of flavor means the few bites are wanted and finished rather than half-returned. Protein-forward composition means those bites carry the grams the body most needs on a small intake. Bitterness attenuation

means the nourishing vegetables actually get eaten instead of left. Clean sweetness means the sweet moments cost little and deliver their brightness. Every one of these is an *attribute of the food* — a measurable property we engineer and you can taste — and not a thing the food does to you. That distinction is the whole of our honesty, and we hold it exactly.

ATTRIBUTE	HOW THIS KITCHEN DELIVERS IT	AXES AT WORK
Taste that lands on a changed palate	loud, low-EC_{50} designed ingredients	U · K · S · C · P
Protein genuinely wanted	savory voice built into legume and soy	U · K
Vegetables finished, not left	bitterness tuned down 20–65%	B
Sweetness without the sugar load	high-potency clean sweeteners	S · B
A small plate that satisfies	continuity built into every bite	K

The through-line

The family has believed one thing from the beginning, through every book in this library and every construct in the greenhouse: that designing flavor and designing nourishment are the same act. You cannot separate making a vegetable delicious from getting its nourishment into a body, or making a protein wanted from the protein being eaten. Flavor is not decoration on top of nutrition; flavor is the mechanism by which nutrition reaches a person at all. A functional kitchen is simply that belief made daily — the understanding that for a changed appetite, the most nourishing thing we can do is also the most delicious, because the delicious is what gets finished. This is the quiet center of everything we grow, and on a small plate it is no longer quiet at all. It is the whole point.

What we grow next

This kitchen cooks from forty-two host organisms and the roughly 225 distinct construct designs — packaged across approximately 19,500 product SKUs — that the platform has built, and it is only the beginning of what the method can reach. Sixty-four concept organisms sit on the roadmap beyond the live library — a volcanic tomato, a sweet-heat strawberry, legumes and grains tuned further toward protein and density than anything on these pages — and each one, as it comes real, becomes a new loud ingredient for a kitchen like this. The frontier that other books in this library dramatize for its spectacle, we read here for its nourishment: every new organism is another way to make a small plate carry more, another axis of flavor and another gram of what the body needs, folded into a few bites someone will actually want. We are a family that grows things, and what we are growing, in the end, is a table where eating less never means being nourished less or delighted less — where the smaller plate is not a loss but a more honest, more concentrated, more cared-for way of being fed. That table is already set. Pull up a chair; a little is about to be more than enough. These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory.