

THE SCOVILLE SPLICE LIBRARY · CUISINES

Engineered Vietnamese

Heat is only half the sentence. *The other half is green.*

Vietnam's balance of fire, herb, ferment, and sour — rebuilt from designed plants and read, dish by dish, on all eight axes. A cuisine of intuition, written down at last in the language of the receptor.

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

Contents

01 Opening essay · Balance was always the point

02 Chapter 1 · Nước Chấm — the sauce that scores a cuisine.

03 Chapter 2 · The Herb Plate — fire answered in green.

04 Chapter 3 · Sả & Gừng — the pungent spine.

05 Chapter 4 · Phở — the long broth, read at last.

06 Chapter 5 · Kho — sweet turned deep.

07 Chapter 6 · Savory Depth, by the Number — the duet, designed.

08 Chapter 7 · Gỏi Cuốn — cool in the hand.

09 Chapter 8 · Gỏi — the raw, bright salad.

10 Chapter 9 · Canh Chua — the sour soup.

11 Chapter 10 · Bright Heat — the sting that lifts, not levels.

12 Chapter 11 · Bún — a bowl in balance.

13 Chapter 12 · Bánh Mì & Đồ Chua — brightness you can bite.

14 Chapter 13 · Cà Phê Sữa Đá — bitter, tamed and poured over ice.

15 Chapter 14 · Nước Mát & Chè — cooling, by design.

16 Chapter 15 · Sinh Tố & the Fruit Frontier — sweetness that grew that way.

17 Chapter 16 · The Composed Meal — full-spectrum at the scale of a table.

18 Chapter 17 · Precision & the Clean Plate — the quiet discipline under all of it.

19 A closing grace · at a borrowed table

Opening essay · Balance was always the point

We came to this table as guests. A Vietnamese kitchen does not need us; it worked out, centuries before anyone wrote down a receptor, the thing our whole index was built to measure — that a flavor is not one sensation but several, held in tension, and that the art is in the holding. We came to learn, and we are writing down what we found with the one tool we have to offer in return: a way to read, in numbers, the balance this cooking already keeps by heart.



Dawn in the research greenhouse — where we learned to read, in numbers, what a cook already knows by hand.

Think of a single spoon of nước chấm. Fish sauce brings the deep savory pull of umami — free glutamate settling onto mGluR1 and the TAS1R1·TAS1R3 heterodimer, the receptors that tell the body *here is nourishment, here is protein.* Sugar lifts sweetness through the TAS1R2·TAS1R3 pair. A crushed bird's-eye chili lands capsaicin on TRPV1, the heat channel. Lime brings the sour, a pinch of salt the salt — the two old tastes our index leaves to the cook — and all of it is tuned, at the table, by eye and by tongue, until no single voice wins. That spoon is a composition. Vietnamese cooking is full of them, and every one is a small working model of what we spend our days designing by machine.

What our index adds is not better taste; it is a way to *see*. Eight axes, one for each pathway through which a plant speaks to the body, each a single number anchored not to a memory but to the half-activation of a receptor:

> **IFI(candidate) = 1,000 × EC_{50}(reference) ÷ EC_{50}(candidate)**

EC_{50} is the concentration at which a stimulus drives its receptor to half of full response. It is an inverse measure of loudness: the *less* of a compound it takes to half-fill the channel, the louder that compound speaks. Invert the ratio against a fixed native reference, scale by a thousand, and loudness becomes a score — a number a chili, a tomato, and a cup of robusta can all be read against on one page. We cap each axis at a normalization maximum of 5,000, so the whole living world of flavor fits on a single ruler.

CODE	AXIS	RECEPTOR	WHAT IT READS	ANCHOR STIMULUS (IFI = 1,000)
IFI-H	Heat	TRPV1	capsaicin warmth, the trigeminal fire	capsaicin, native reference EC_{50}
IFI-P	Pungency	TRPA1	allicin, ginger, the quick sharp sting	allyl isothiocyanate, convention constant
IFI-C	Cool-Burn	TRPM8 / TRPV1	menthol cool, thermomodulation	menthol, reference
IFI-U	Umami	mGluR1 / TAS1R1·TAS1R3	savory depth, the brothy pull	L-glutamate, reference
IFI-S	Sweetness	TAS1R2 / TAS1R3	sugar-free sweetness	sucrose-equivalent reference
IFI-B	Zero-Bitter	TAS2R38 (and the TAS2R family)	bitterness *attenuation*, 20–65%	PROP/caffeine-class reference
IFI-K	Kokumi	CaSR	richness, continuity, mouthfeel	γ-Glu-Val-Gly, reference
IFI-A	Astringency	salivary PRPs	tannin grip, polyphenol pucker	reference tannin set

Read down that column and a cuisine of intuition becomes a cuisine you can write down — and, because we grow the plants ourselves, a cuisine you can rebuild from the plant up: a tomato with its umami grown back, a mint engineered to cool harder, a coffee bean with its bitterness gently turned down, a chili laddered to any warmth a dish asks for. Across the platform that stands behind this book, that work today runs to roughly **19,000 engineered constructs across 42 host organisms**, of which **1,000 are live and growing**, every one designed to these same eight axes at a batch-to-batch coefficient of variation of **7% or less**. The method and its numbers are not folklore; they are documented across **21 peer-reviewed papers** released openly on Zenodo under CC BY 4.0, with **three patents** filed.

And underneath the mathematics, the thing we love most about this food and never stop learning from: it is already clean. Light broths, a whole plate of raw herbs, vegetables barely touched by heat, pickles that wake the mouth — a way of eating that feeds the body gently without ever being told to. We did not design that. We only grew the plants to carry more of what makes it worth eating, and scored each dish so you can taste the balance and read it at once. This book is plant-reverent and vegetarian-first by default, the way the cuisine itself leans; where meat and seafood belong, we write them with the same respect and the same arithmetic, never as an afterthought and never as an apology.

A word on the voice before we begin. We write as *we* — a family of growers and cooks, with one pair of hands at the keyboard and the whole table behind the work. When we say a plant "nourishes," we mean it the way a cook means it, as care and intention, never as a medical claim: we will tell you precisely what a molecule does to a receptor, and we will never tell you what it does to your health. That discipline — reverence held by rigor, wonder woven to the number — is the whole house style, and nowhere is it easier to keep than here, at a table that has always believed the same thing.



PART I OF VI

The Grammar

Nước chấm · the herb plate · the pungent spine — the axes this cuisine speaks before it says a word

Chapter 1 · Nước Chấm — *the sauce that scores a cuisine.*

Every Vietnamese meal has a small bowl at its center, and nearly everything on the table goes for a swim in it. Nước chấm is dipping sauce, but that word is too small. It is the cuisine's thesis in liquid form: four or five tastes brought into a balance so exact that a cook adjusts it the way a tuner adjusts a string — a little more lime, a little more sugar — until it rings. Make it once, paying real attention, and you have learned to read a scorecard with your mouth.

Start with the fish sauce, because it is the loudest voice and the oldest. Nước mắm is anchovy and salt layered in wood and left to the sun for a year or more, and what time does to it is, at root, a controlled autolysis: the fish's own proteases, plus the enzymes of halophilic bacteria that tolerate the brine, hydrolyze muscle protein down to free amino acids. Chief among them is L-glutamate. A first-press sauce can carry well over a gram of free glutamate per 100 mL — which is to say it is close to pure umami, the single most concentrated natural source of the taste there is. On the tongue that glutamate finds two receptors at once: the taste-variant metabotropic glutamate receptor mGluR1, and the TAS1R1·TAS1R3 heterodimer, both of which read it as savory depth, as the signal of protein and broth and being fed.

Here is the first piece of real chemistry that a good nước chấm exploits, and it is the reason the sauce needs so little sugar. Umami and sweetness are not rivals; they are collaborators that make each other legible. Glutamate on the T1R dimer does not merely add its own note — it is potentiated, allosterically, by 5′-ribonucleotides (the inosinate and guanylate that the ferment and the aromatics also carry), and the combined signal can run as much as **eight times** stronger than glutamate alone. That same savory floor lowers the threshold at which the TAS1R2·TAS1R3 pair registers *sweet*. Build the umami honestly and the sauce tastes sweeter at less sugar. The whole quiet logic of the dish — and of half the dishes after it — is right there: depth first, sweetness second, and the sugar bowl used with a gentle hand.



Soybean, the chay engine — fermented on koji into a garum that carries nước mắm's umami weight on the same receptor, meatless.

We make the sauce meatless as often as not, and we are not willing to lose a thing when we do. A soy garum — soybean cooked soft, inoculated with *Aspergillus oryzae* (koji), salted, and left to the same slow autolysis that makes fish sauce — arrives at the same destination by a parallel road: koji's protease battery (its carboxypeptidases and the glutaminase that converts glutamine to glutamate) liberates free glutamate in quantity, so the chay bowl reads on mGluR1 exactly as the nước mắm bowl does. Our soybean line carries **360 engineered constructs**, tuned among other things to raise the pool of glutamate precursor the ferment has to work with, and our koji mold line adds **80 more** on the enzyme side; the shiitake and yeast lines behind the pantry (**80** and **240** constructs respectively) stack 5′-guanylate into the same build, so the ribonucleotide synergy above is not left to chance. Fish sauce or soy garum — the balance is the point, not the source.

Nước Chấm

Makes about 1 cup · 10 minutes · the sauce the whole book leans on

You need

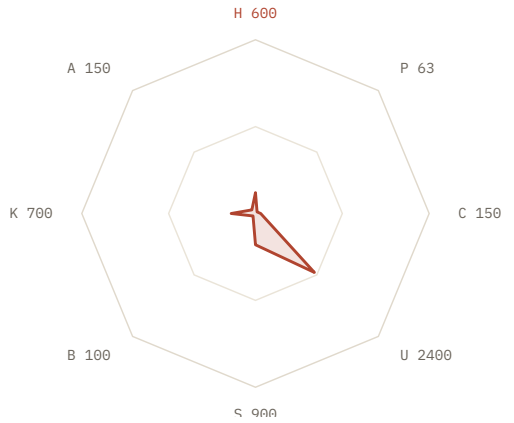
3	tbsp	warm water
2	tbsp	sugar (or engineered sugarcane syrup)
2	tbsp	lime juice, fresh
3	tbsp	fish sauce (or soy garum, for nước chấm chay)
1	clove	garlic, finely minced
1–2		bird's-eye chilies, minced

Make it

1. Stir the sugar into the warm water until it fully dissolves — this first, always, so nothing stays grainy and the sweetness is evenly spread before anything else arrives.
2. Add the lime juice, then the fish sauce or soy garum. Taste. It should arrive, in order, sweet, then sour, then deeply savory, with salt running under all of it. If one voice is too loud, answer it with its opposite, not with more of itself: too sharp, a little sugar; too flat, a little lime.
3. Stir in the garlic and chili last so they float on top and stay bright. Let it sit five minutes before you use it — the garlic needs a moment to open, and the salt needs a moment to find the sugar.

Why it works — The classic ratio chefs teach is roughly 1 : 1 : 1 sugar : lime : fish sauce, loosened by an equal or greater part water, and the index explains why that proportion holds across a thousand kitchens. Each of those three is doing one axis of work — sweet on T1R2·R3, sour (unscored, the cook's own) on the acid-sensing channels, umami-plus-salt on the T1R1·R3/mGluR1 pair — and the water is the normalization term, pulling every axis back below the threshold where it would dominate. Build the savory from a real ferment and the umami-sweet potentiation does the rest: you reach balance with less sugar than the raw numbers suggest, which is the whole elegance of the thing.

IFI PROFILE



IFI-H	600
IFI-P	63
IFI-C	150
IFI-U	2,400
IFI-S	900
IFI-B	100
IFI-K	700
IFI-A	150

A note, quiet: we make the chay version on koji — the same gentle culture that has deepened savory sauces for a thousand years — because a sauce this central should be able to be meatless without giving up a thing. The glutamate it lays on mGluR1 is molecule-for-molecule the same glutamate the anchovy gives; the receptor cannot tell which field it came from, and neither, honestly, can the table.

Chapter 2 · The Herb Plate — *fire answered in green.*

No other cuisine gives herbs their own plate. In Vietnam they arrive raw and whole, a small forest set beside the bowl — mint, Thai basil, perilla, cilantro, the citrus bite of rau răm, the sawtooth blade of ngò gai — and you tear them in yourself, bite by bite, so the dish is never finished until you finish it. This is not garnish. It is the other half of the thermostat, and it is the clearest thing on the whole table that the cuisine thinks about heat and cooling as two ends of one axis.



Basil, whole and raw — the herb plate is the cuisine's built-in counterweight to the chili bowl.

Heat, on the index, is TRPV1 — a non-selective cation channel on the trigeminal nerve endings of the tongue, the same channel gated by temperatures above 43 °C and by acidic protons. Capsaicin does not warm the tissue; it binds a pocket in the channel's transmembrane domain and lowers its thermal threshold, so the body reports a fire that is not there. Cooling is its structural mirror. Menthol activates TRPM8, a channel from the same TRP superfamily that opens to actual cold and, deceived by menthol exactly as TRPV1 is deceived by capsaicin, reports a chill with no drop in temperature. A mouth that has just met chili reaches, on its own, for mint; the herb plate is that reach, built into the architecture of the meal.

What happens when the two arrive together is not simple subtraction, and the distinction matters if you want to design it. TRPV1 and TRPM8 are different channels on different nerve fibers, so menthol does not "cancel" capsaicin at the molecule. What it does is add a second, opposing thermal signal that the brain integrates downstream — and, through a slower mechanism, menthol's cooling raises the perceptual threshold for the burn, so the fire reads as placed and bright rather than scorching. The two sensations do not erase each other; they hold each other, and the holding is the pleasure. It is the reason you can eat this food hot and leave the table calm.

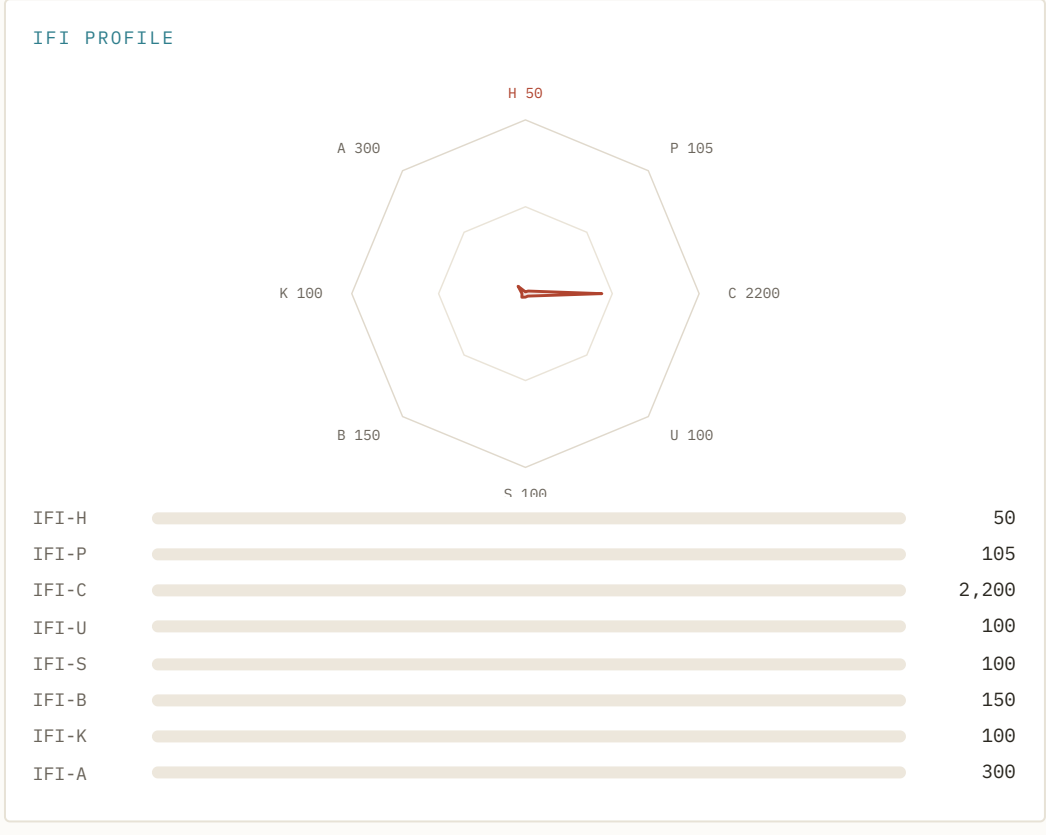
This is the one place on the plate we could not resist improving the plant. Menthol is the product of a short, beautiful biosynthetic route in *Mentha* — the committed menthol pathway, five dedicated

enzymes long, that turns the terpene limonene into the cooling alcohol:

STEP	ENZYME	CONVERTS	TO
1	limonene synthase (LS)	geranyl diphosphate	(−)-limonene
2	limonene-3-hydroxylase (L3OH, a CYP71D)	(−)-limonene	(−)-trans-isopiperitenol
3	isopiperitenol dehydrogenase (IPD)	isopiperitenol	isopiperitenone
4	isopiperitenone reductase (IPR) + pulegone reductase (PR)	isopiperitenone	(+)-pulegone → (−)-menthone
5	menthone reductase (MMR)	(−)-menthone	(−)-menthol

Our peppermint line carries **2,360 engineered constructs** — one of the deepest builds in the whole library — aimed squarely at the flux through that ladder: up-regulate the committed first step, relieve the bottleneck at the P450 hydroxylation, and push the terminal reductases so that less of the harsh, slightly bitter intermediate pulegone survives and more of the clean terminal menthol accumulates. The result is a leaf our model predicts to cool harder than the plant ever did on its own — a single torn leaf reading near **IFI-C 2,200**, a clean rush that arrives a half-second behind the heat and clears it. We gave spearmint's softer, carvone-led cool the same lift (**80 constructs** on that line) and left the Thai basil and perilla alone, because some things are already right. Grow the cool stronger and you need less of it; the plate stays light, the balance stays exact.

The rest of the plate is doing quieter axis work. Perilla (tía tô) and rau răm carry their own sharp aldehydes and the TRPA1-active compounds that register as pungency — the green, almost peppery edge that keeps the plate from being merely sweet-cool. And every raw leaf brings a faint astringency, polyphenols binding the proline-rich proteins of the saliva into the gentle grip that makes a mouthful of herbs feel like it has texture as well as taste. Read as a single composed object, the herb plate scores like this:



We think of the herb plate as the cuisine's thesis stated in the negative: not what to add, but what to answer with. It is the only "recipe" in this book with no fire under it and no knife work worth the name — a bowl of cold water for the leaves, a plate, and the understanding that the cook's last job is to hand the balance to the eater and step back.

Chapter 3 · Sả & Gừng — *the pungent spine.*

Under the herbs and above the broth runs a spine of aromatics that nearly every savory Vietnamese dish is built on: lemongrass, ginger, galangal, garlic, shallot. These are the pungent plants — the sharp, bright, front-of-mouth sensations that fire TRPA1, heat's quick cousin. Where capsaicin on TRPV1 lingers and blooms, pungency flashes and is gone: the clean sting of raw ginger, the allicin bite of a just-crushed clove, present almost before you taste it and leaving the dish lifted rather than scorched. Pungency is where a Vietnamese cook tunes the top note, and it rewards being understood as its own axis.



Ginger, split to the fiber — gingerol on TRPA1 and TRPV1, and the shogaol that heat makes from it.

Take garlic first, because it is the cleanest piece of chemistry on the whole spine. An intact clove holds no allicin at all — only the odorless, stable amino acid alliin, kept in the cytoplasm, and the enzyme alliinase, kept apart from it in the vacuole. Crush the clove and you break the compartments; alliinase finds alliin and, in seconds, converts it to allicin, the volatile thiosulfinate that is garlic's whole pungent soul. Allicin is a direct TRPA1 agonist — it reacts covalently with cysteine residues on the channel's cytoplasmic face, pulling it open. This is why the *timing* of garlic is a flavor decision with a molecular basis: crush it and wait, and the allicin pool builds; cook it immediately, and much of the alliin never converts, or the allicin decomposes to the milder diallyl sulfides before it reaches the tongue. Our garlic line (**560 constructs**) is tuned on the front half of that reaction — a larger alliin reserve and a brisker alliinase — so a clove grown for the spine delivers its sharp signal cleanly and on cue.

Ginger runs a parallel but distinct chemistry, and it is one of the few aromatics whose pungency you can watch change as you cook it. Fresh ginger's heat is 6-gingerol, which activates both TRPV1 and TRPA1 — a warm, bright pungency. Apply heat, or dry the rhizome, and gingerol dehydrates to 6-shogaol, which is markedly *more* pungent and shifts the sensation deeper. So fresh ginger in a last-second julienne and ginger simmered for an hour in a broth are, quite literally, two different stimuli on the channel. Our ginger line

(**120 constructs**) is designed to raise the gingerol pool at harvest; what the cook does with heat decides where on the gingerol-to-shogaol continuum the dish lands.

AROMATIC	LINE (CONSTRUCTS)	ACTIVE COMPOUND	CHANNEL	CHARACTER
Garlic	560	allicin (from alliin + alliinase)	TRPA1	sharp, volatile, built on crushing
Ginger	120	6-gingerol → 6-shogaol (on heat)	TRPV1 + TRPA1	bright fresh → deep cooked
Onion / shallot	40	thiosulfinates, lachrymatory factor	TRPA1	sweet when cooked, sharp when raw
Cassia (Vietnamese cinnamon)	40	cinnamaldehyde	TRPA1	warm, sweet-sharp, the phở note

Lemongrass and galangal bring the citral and galangal diterpenes that round the spine out into fragrance rather than sting, and that is the other half of the craft: pungency is the one axis most transformed by heat. Bloom these aromatics gently in oil and the raw TRPA1 edge softens into aroma — the sharp molecules volatilize or react away, and what is left is depth and perfume. Leave them raw and they cut. Same plant, two instructions.

Sả Ớt — Lemongrass-Chili Aromatic Oil

Makes 1 jar · 20 minutes · the flavor base under half this book

You need

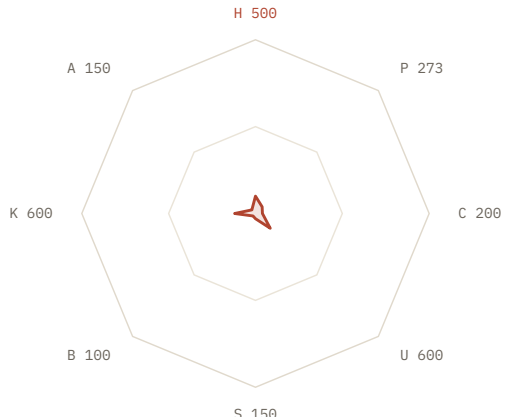
```
6   stalks lemongrass, minced fine (tender lower third only)
4   cloves garlic, minced
2          shallots, minced
2          chilies, minced
1   thumb  ginger, grated
4   tbsp   neutral oil
1   tsp    soy garum
```

Make it

1. Warm the oil gently — you want it to shimmer, never to smoke. Add everything but the soy garum.
2. Cook low and slow until gold and deeply fragrant, 12 to 15 minutes, low enough that nothing browns hard. You are converting raw pungency into aroma: listen for the sizzle to quiet and the smell to turn from sharp to sweet.
3. Stir in the soy garum off the heat, so its glutamate is not cooked flat. Keep it in the fridge; spoon it into noodles, over rice, through a stir-fry, under a braise. It is the understory of the whole savory side of this book.

Why it works — Blooming is a pungency-to-aroma conversion you can taste happening. The allicin and the gingerol that would read as a raw sting on TRPA1 are heat-labile; held at a gentle temperature they volatilize and rearrange into the mellow sulfides and the warm sesquiterpenes that read as depth, not bite. A spoonful of soy garum at the end lays a quiet umami floor (IFI-U) under the whole thing, so the oil carries savory as well as perfume.

IFI PROFILE



IFI-H	500
IFI-P	273
IFI-C	200
IFI-U	600
IFI-S	150
IFI-B	100
IFI-K	600
IFI-A	150



PART II OF VI

The Long Cook

Phở · kho · the savory duet — umami, kokumi, and caramel, or how depth is grown in rather than simmered out

Chapter 4 · Phở — *the long broth, read at last.*

Phở is a broth with a vocabulary. Onion and ginger charred black over a flame until they turn sweet and smoky; star anise, cassia, clove, and coriander toasted and tied in a cloth; the whole thing drawn for hours until the liquid goes from water to something with weight. What you are tasting, when a phở is right, is two axes at once — umami, the savory pull, and kokumi, the body underneath it that has no flavor of its own and yet is the entire difference between a broth and hot salty water. To understand phở on the index is to understand the savory duet, and the duet is the most useful thing in this book.



Onion, halved — charred black over the flame, it is the sweet-smoke top note of every real bowl.

Umami you already met at the nước chấm bowl: free glutamate on mGluR1 and TAS1R1·TAS1R3, the forward savory note. Kokumi is subtler and, until recently, nearly unnameable. It is carried by γ-glutamyl peptides — short chains like γ-glutamyl-valyl-glycine and glutathione — that are not themselves tasty. They bind the calcium-sensing receptor, CaSR, a receptor better known for monitoring blood calcium, and when CaSR is engaged on the tongue it does something strange and wonderful: it does not add a taste of its own, it *modifies* the others, lending them continuity, thickness, a sense of filling the whole mouth and lasting. A broth with umami but no kokumi tastes correct but thin; add the γ-glutamyl peptides and it gains body and length, the quality cooks call *round*.

The science of the long simmer is the science of both at once, built by time. Hours of gentle heat hydrolyze protein and free glutamate from the aromatics and the kombu — umami, rising. The same hours, through slow enzymatic and thermal reactions, build and concentrate the γ-glutamyl peptides — kokumi, deepening. Meat phở finds its kokumi through bone and marrow and a day of patience. We found we could grow much of it in, and hand the afternoon cook the result of the overnight pot.



Reading a molecule the way a cook reads a broth — the microscope stage where a line is checked before it is ever grown out.

The pantry that makes a meatless phở taste like a boned one is four organisms deep. Dried shiitake carry glutamate *and* 5′-guanylate, so they bring both the umami and its ribonucleotide potentiator in one ingredient (the shiitake line, **80 constructs**, is tuned to raise the guanylate pool). Kombu is the kelp whose glutamate first taught the world what umami even was. And a spoon of koji-fermented soybean paste brings the γ-glutamyl peptides that read as kokumi, grown dense through the soybean line's **360 constructs** and the koji line's **80**. Stacked, these give a 75-minute broth a depth that used to take a day of bones — IFI-U and IFI-K lifted at the source rather than coaxed out of something over a fire.

Phở Chay

Serves 4 · 90 minutes, mostly unattended · the vegetable broth that reads like a bone

A vegetarian phở usually apologizes for itself — thin, over-sweet, missing the floor. This one does not, because the floor is grown in. Make the broth a day ahead if you can; like all good things it is better once it has had a night to think.

You need

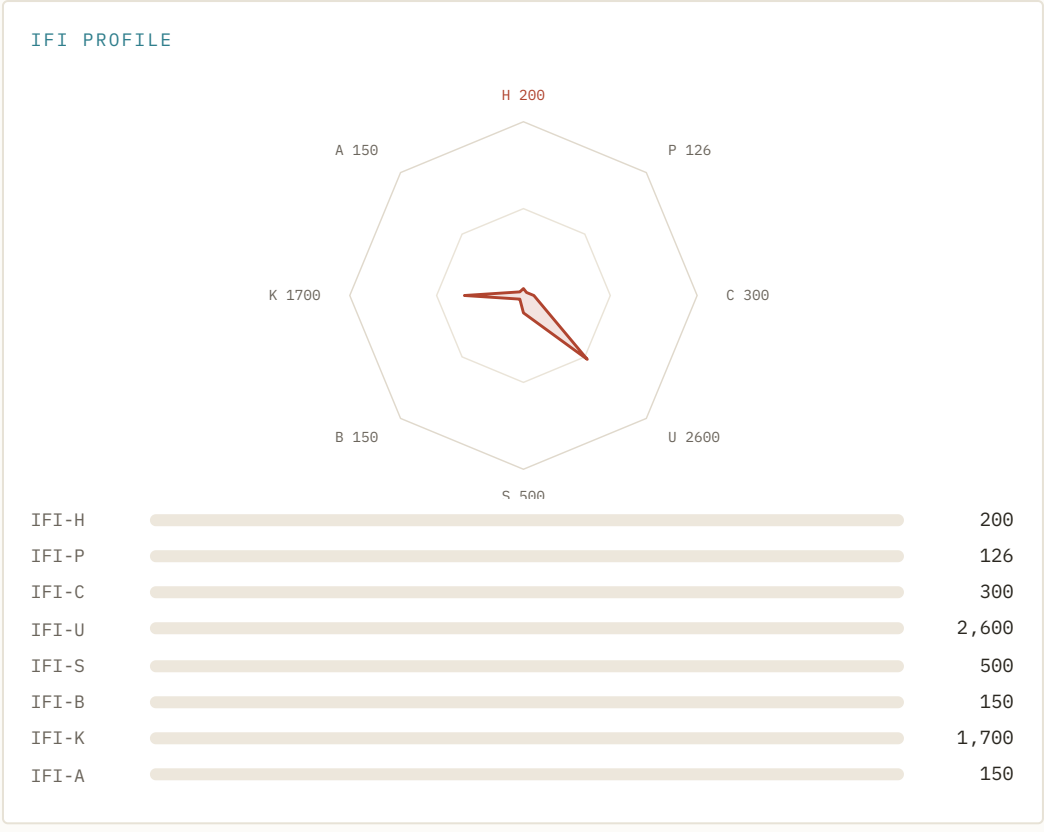
2	large	onions, halved, skins on
1	hand	ginger, split lengthwise
6		dried shiitake, the umami-and-guanylate engine
1	strip	kombu (a 10 cm piece)
3		star anise
1	stick	cassia (Vietnamese cinnamon)
3		cloves
1	tbsp	coriander seed
2	tbsp	soy garum or engineered soybean paste
1	tbsp	rock sugar
		rice noodles (bánh phở); to serve: Thai basil, cilantro, ngò gai (sawtooth herb), bean sprouts, lime, sliced chili

Make it

1. Char the onion and ginger directly over a flame (or under a hot broiler) until blackened in patches and fragrant. This smoke is not optional; the charring is a Maillard reaction on the cut faces, and the roasted, sulfurous, slightly sweet molecules it makes are the top note of the whole bowl.

2. Toast the star anise, cassia, clove, and coriander in a dry pot until they bloom and smell warm, then add 3 quarts (about 2.8 L) water, the charred aromatics, the shiitake, and the kombu. Bring to the barest tremble — never a rolling boil, which emulsifies and clouds — and hold it there 75 minutes. Pull the kombu after 20 minutes so it does not turn the broth grassy.
3. Strain into a clean pot. Season the clear broth with the soy garum and rock sugar until it tastes deep and round, not salty. Adjust toward *savory*, not toward salt: if it tastes flat, it wants umami (more garum), not more sodium.
4. Soften the noodles, pile them in warm bowls, pour the near-boiling broth over, and carry the herb plate to the table. The bowl is finished by the person eating it — a fistful of herbs, a squeeze of lime, as much chili as they dare.

Why it works — Umami and kokumi ask for each other, and this broth is built to give them both without the bones. The free glutamate (shiitake, kombu, garum) lands the forward savory note on mGluR1; the 5′-guanylate (shiitake) potentiates it severalfold on the T1R1·R3 dimer; the γ-glutamyl peptides (fermented soybean) engage CaSR for the body and the length. That is three molecular levers, three ingredients, one bowl — and it is why the result reads deep rather than merely salty.



For a table that eats meat: the method is identical over beef bones and brisket, and the engineered pantry only deepens it — a spoon of the shiitake-soybean build in a bone broth pushes the umami and kokumi past where either the bones or the plants reach alone. We mean that as respect for the classic bowl, not a correction of it.

Chapter 5 · Kho — *sweet turned deep.*

Kho is the home cooking at the opposite pole from the herb plate — dark, slow, a clay pot of something braised in caramel until it is almost black and entirely savory. It begins with sugar cooked past sweet: melted alone in the pot until it turns the color of teak and starts to smell faintly bitter, the caramel the Vietnamese call nước màu, "color water." Into that goes the braise, and the sweetness that started the dish disappears into depth. It is the most quietly radical transformation in the cuisine, and the index can almost watch it happen.



Sugarcane — grown high in its own native sugars, it caramelizes darker and rounder, spending sweetness entirely on depth.

Sweetness is the TAS1R2·TAS1R3 pair, and sucrose is its plain agent. But heat sucrose past about 170 °C and it stops being sucrose: it fragments and recombines through caramelization into hundreds of new molecules — the furans, the maltol and its relatives, the brown nitrogen-free polymers — most of which do not read as sweet at all. They read as roasted, faintly bitter, and, crucially, *round*: the caramel compounds engage the kokumi machinery and lend the braise a deep, mouth-filling, almost meaty body. A little of the sweetness survives to round the salt; the rest has been spent, deliberately and irreversibly, on depth. Our sugarcane line (**200 constructs**) is grown high in its native sugars not only to sweeten but to caramelize better — more substrate into the browning reactions means a darker, rounder nước màu and a deeper floor under the pot.

This is worth dwelling on because it inverts the usual intuition about an engineered sweetness. We build sugarcane, and stevia (**910 constructs**), and monk fruit (**80**), to make things *taste* sweet with less metabolic sugar — that is the drinks-and-dessert story of Part V. But kho asks the opposite question: not how to keep the sweetness while losing the sugar, but how to spend the sugar entirely and keep none of the sweetness, converting all of it to kokumi and pseudo-umami in the pot. The same plant serves both ends. What changes is the instruction.

Nấm Kho — Mushroom & Tofu in Caramel

Serves 4 · 45 minutes · the clay-pot braise, made meatless and not missing it

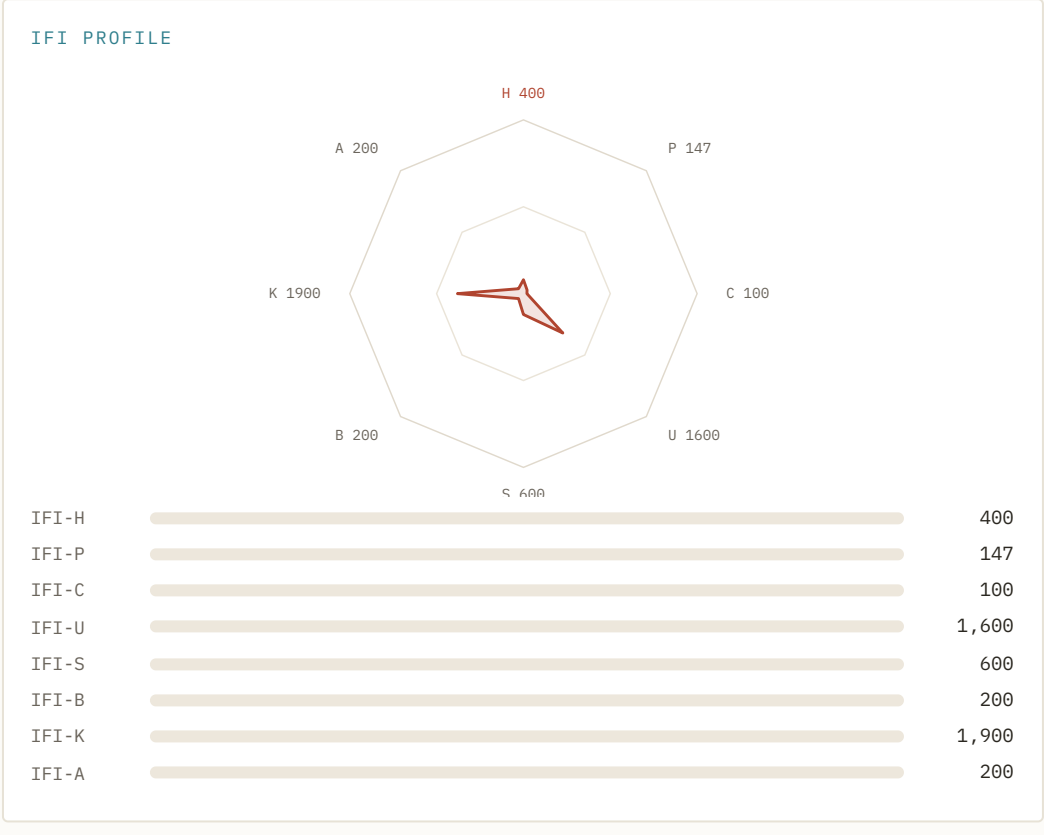
You need

```
3   tbsp   engineered sugarcane syrup (or sugar) — for the caramel
400 g      firm tofu, cubed and pan-crisped
300 g      cremini or fresh shiitake, halved
3          shallots, sliced
3   cloves garlic
2   tbsp   soy garum
1   cup    coconut water
           black pepper, a chili, scallion to finish
```

Make it

1. In a heavy pot, melt the sugarcane syrup alone over medium heat until it darkens to deep amber and smells just shy of burnt — this caramel is the soul of the dish, and the line between glorious and acrid is about fifteen seconds wide, so watch it. Stand back and add the shallots and garlic to stop the browning and perfume the caramel.
2. Add the mushrooms, crisped tofu, soy garum, and coconut water. It should barely cover. Simmer, uncovered, until the liquid reduces to a glossy, clinging sauce — 25 to 30 minutes. The reduction is where the umami concentrates.
3. Finish with a heavy hand of cracked black pepper, sliced chili, and scallion. Serve with plain steamed rice, which is the whole point of all that intensity: the braise is a condiment for the grain as much as a dish of its own.

Why it works — The caramel is sweetness transformed, not sweetness added. Pushed well past its receptor, the sugar becomes the deep savory-bitter architecture the braise is built on — kokumi on CaSR, a roundness that reads almost like meat because it is doing some of the same molecular work that meat's long cooking does. The coconut water and mushrooms bring real glutamate underneath; the black pepper (piperine, a TRPV1 and TRPA1 agonist in its own right) lifts it. A sweet plant, grown sweeter, spent entirely on depth.



Chapter 6 · Savory Depth, by the Number — *the duet, designed.*

Phở and kho are the two faces of one problem, and it is the problem our platform spends more of its days on than any other: how to build real savory depth — umami and kokumi together — reliably, at a number, in a plant rather than a pot. Savory depth is our single most-requested combination, the U×K intersection, and it is worth one chapter of pure mechanism before we return to the plate, because once you understand the duet you can read it everywhere on a Vietnamese table.



The analytical bench where a savory build is quantified — glutamate and γ-glutamyl peptides counted, not guessed.

Begin with the two receptors, because they are genuinely different machines. The umami receptor TAS1R1·TAS1R3 is a Venus-flytrap dimer: glutamate binds in the cleft of the flytrap and closes it, and a 5′-ribonucleotide (IMP, GMP) binds at the hinge and stabilizes the closed, active state — which is the structural reason for the eightfold synergy, two ligands cooperating on one receptor. The metabotropic mGluR1 is a second glutamate sensor, class-C, that contributes the lingering savory tone. The kokumi receptor CaSR is a different class-C GPCR entirely, and its agonists are not amino acids but short γ-glutamyl peptides; it reports not a taste but a *modulation*, pushing the perceived intensity and persistence of sweet, salty, and umami upward. Umami is a note; kokumi is a dimmer switch on all the notes at once.

Now the design problem. To raise umami in a plant, you raise free glutamate — which means feeding the glutamate node of central nitrogen metabolism and limiting the enzymes that pull glutamate back into glutamine or protein. To raise kokumi, you raise the γ-glutamyl peptides — which means driving the γ-glutamyl cycle, principally the enzyme γ-glutamyl-cysteine synthetase and the glutathione pathway, and the transpeptidases that build the longer peptides. These are not the same intervention, and pushing one can starve the other, because both draw on the same glutamate pool. This is exactly the kind of trade-off a **genome-scale flux-balance model** exists to resolve: represent the whole metabolic network as a

stoichiometric matrix, impose the mass-balance constraint that what flows into each metabolite flows out, and solve for the enzyme expression pattern that maximizes *both* the glutamate pool and the γ-glutamyl flux without breaking the cell. The model tells us which steps are the true rate limiters and which are red herrings, so we edit four or five genes with intent instead of forty by trial.

TARGET	AXIS	LEVER	REPRESENTATIVE ORGANISMS (CONSTRUCTS)
free L-glutamate	IFI-U	feed glutamate node; limit glutamine synthetase pull	tomato (2,040), soybean (360), shiitake (80)
5′-guanylate / inosinate	IFI-U (synergy)	raise ribonucleotide pool for T1R hinge	shiitake (80), yeast (240)
γ-glutamyl peptides	IFI-K	drive γ-glutamyl cycle / glutathione route	soybean (360), koji mold (80), garlic (560)
continuity / mouthfeel	IFI-K	CaSR-active peptide profile	yeast (240), vanilla (40)

The multi-axis libraries that come out of this work are real and counted: the dual-axis **M2** library runs to **8,400 constructs**, the triple-axis **M3** to **2,800**, and the full eight-axis composite program (the one that produced Phoenix, which you will meet in Part IV) sits at the pinnacle of the whole thing. For a Vietnamese kitchen, the payoff is the one you taste in the phở and the kho: a savory floor that does not depend on bones or long hours or a great deal of salt, because the glutamate and the γ-glutamyl peptides were grown into the shiitake and the soybean before they ever reached your pot.

To make the duet tangible, here is the ferment that puts the most of both into a single jar — a soy garum you can build at home, the chay backbone of everything savory in this book.

Soy Garum (Nước Tương Ủ) — the chay umami engine

Makes about 500 mL · active 30 minutes, then 6–10 weeks · the floor under the floor

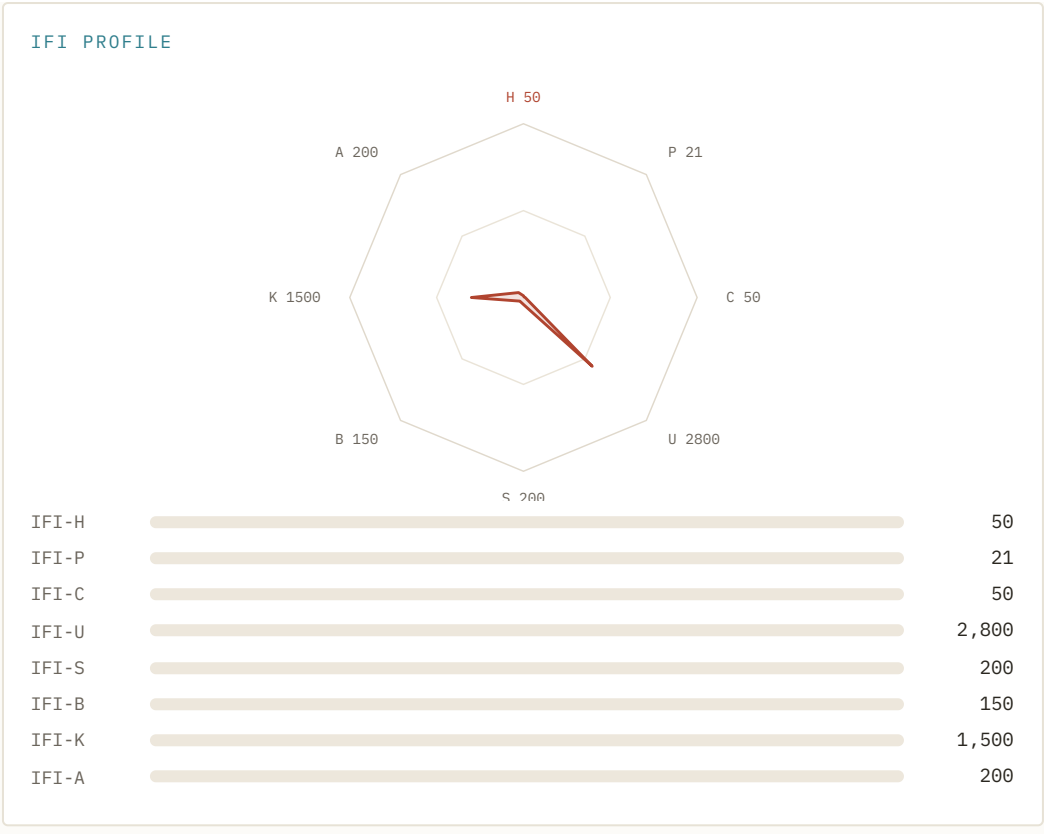
You need

```
400 g     cooked soybeans (or a 50/50 mix of soybean + pearled barley)
100 g     koji (rice or barley inoculated with Aspergillus oryzae)
120 g     salt (about 18–20% of the total mash weight)
600 mL    water
          optional: a strip of kombu, for extra glutamate
```

Make it

1. Blend the cooked soybeans coarse. Mix in the koji, salt, and water to a loose, spoonable mash. The salt is the safety margin — at this concentration the halotolerant ferment proceeds and spoilage organisms do not — so do not cut it.
2. Pack into a clean jar, leaving headroom, press flat, and cover. Keep it warm (around 28–30 °C) and stir once a week, scraping the sides down. You are letting koji's proteases and glutaminase run the same autolysis the sun runs on fish sauce.
3. From week six, taste weekly. When it is savory, round, and clean — no raw-bean edge — strain through cloth. The amber liquid is your garum; press the solids hard to recover the last of it.

Why it works — Every molecule of the savory duet is made here. Koji's carboxypeptidases cleave protein down to free amino acids (glutamate chief among them, deepened by the engineered soybean's raised precursor pool); its glutaminase converts glutamine to still more glutamate; and the slow ripening builds the γ-glutamyl peptides that will read as kokumi. One ferment, both axes — umami forward, kokumi underneath — and no animal in it.



Nourishment note, quiet: a ferment like this is old technology for a modern idea — building deep, satisfying savoriness into plant food so that less salt and less meat have to do the work. We grow the soybean to carry more of what the ferment turns to flavor; the culture does the rest, the way it has for a thousand years.



PART III OF VI

The Cool Side

Gỏi cuốn · gỏi · canh chua — the raw plate, the sour soup, and everything the cuisine does without a fire

Chapter 7 · Gỏi Cuốn — *cool in the hand.*

The fresh spring roll is the coolest thing on the table, in every sense the index can measure. Soft rice paper around cool vermicelli, whole herbs, a leaf of lettuce, a little poached shrimp or tofu — nothing fried, nothing hot, the whole thing assembled rather than cooked and eaten within the hour of making. It is the dish that most plainly shows the cuisine's cool side, and the one we reach for when the rest of the meal runs warm. It is also, quietly, a lesson in how little a dish needs to carry if what it carries is the right thing.



Lettuce, raw and whole — in a gỏi cuốn the leaf is structure, coolness, and nearly the entire cooked-ness of the dish.

On the index a gỏi cuốn sits low and cool almost everywhere. The vermicelli is neutral; the lettuce and herbs carry what little intensity there is, most of it on TRPM8 (the mint and the cool green of the leaf) with a faint astringent grip from the raw vegetable. If the roll were the whole dish it would read as barely-there — and that is the design. The intensity lives in the dip, and the eater controls the ratio in their own hand, roll to sauce, bite by bite. It is nước chấm's lesson again at a smaller scale: hand the balance to the person eating.

The classic dip is a peanut-hoisin sauce with a quiet, deep body — roasted peanut and fermented soybean, kokumi and a low sweetness, the rich counterpoint to all that freshness. Roasting the peanut is itself a flavor reaction worth naming: the Maillard browning builds the pyrazines and the roasted aroma, and the ground nut's fat and protein give the sauce the mouth-coating richness that reads as kokumi against the weightless roll. Cool roll, deep dip — the smallest version of the whole cuisine's balance, held in two hands.

Gỏi Cuốn with Peanut-Hoisin

Makes 10 rolls · 30 minutes · the cool center of the table

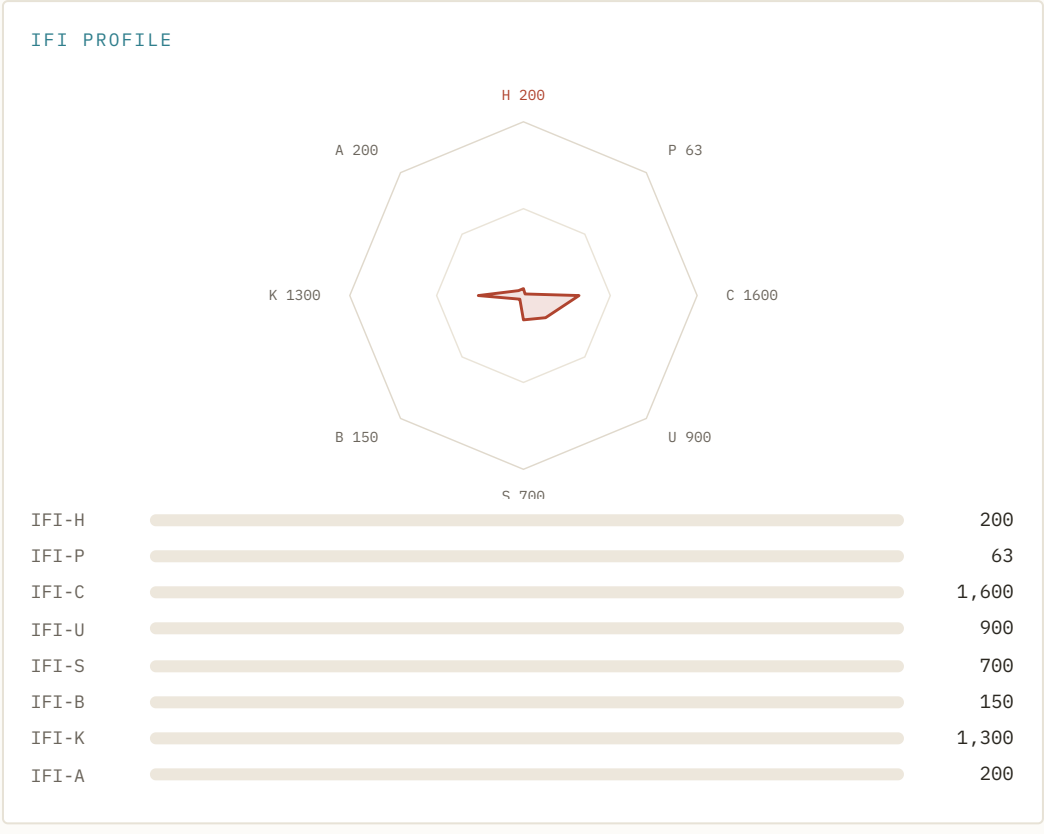
You need

```
10          round rice-paper wrappers
             cooked rice vermicelli, cooled
             butter lettuce, mint, cilantro, garlic chives
             firm tofu (pan-crisped) or poached shrimp, in strips
For the dip:
3    tbsp    hoisin
1    tbsp    smooth peanut butter (or ground roasted peanuts)
1    tbsp    soy garum
             warm water to loosen · crushed peanuts to finish
```

Make it

1. Dip a wrapper in warm water for two seconds only — it keeps softening in your hands, so stop while it still feels slightly stiff, or it will tear.
2. Lay it flat. Near the bottom third, stack lettuce (first, as a waterproof bed), a little vermicelli, a generous pinch of herbs, and two strips of tofu or shrimp laid along the top so they show through. Fold the sides in, then roll up tight and whole, like a small, soft parcel.
3. Warm the hoisin, peanut butter, and soy garum with a splash of water into a loose, pourable sauce. Finish with crushed peanuts for texture. Serve the rolls whole with the dip alongside.

Why it works — Everything in the roll sits low and cool on the index; the herbs carry the only real signal, on TRPM8. The whole experience is tuned by the dip, which brings the only real depth — kokumi from the fermented soybean, richness from the roasted peanut, a soft sweetness from the hoisin — so the bite travels from cool and green to rich and round and back. Freshness is not the absence of flavor here. It is a flavor, and it is the point.



Nourishment note, quiet: this is food at its most whole — raw herbs, uncooked vegetables, nothing stripped by heat. We grow the plants to carry more of what a raw leaf is worth; the dish does the rest by doing almost nothing, which is sometimes the most a cook can do.

Chapter 8 · Gỏi — *the raw, bright salad.*

A gỏi is a salad the way the herb plate is a garnish — which is to say, not really, or not only. Shredded green papaya or banana blossom or raw vegetable, tossed with herbs, peanuts, fried shallot, chili, and a sharpened nước chấm, it is crunch and brightness turned into a whole dish. Where the Western salad is a mild beginning, the gỏi is loud: sour, sweet, hot, sharp, and crisp, all at once and all raw. It is the clearest place in the cuisine to meet the astringency axis honestly, because raw is where astringency lives.



Carrot, shredded raw into the salad — crunch, a faint sweetness, and the bright backbone the dressing clings to.

Astringency is the odd axis, the one that is not, strictly, a taste. IFI-A reads the tannins and polyphenols that bind the proline-rich proteins (PRPs) of the saliva, precipitating them and stripping the mouth of its lubrication — the grip, the pucker, the dry grab of an underripe fruit or a strong tea. Green papaya and banana blossom carry exactly that faint tannic backbone, and in a gỏi it is a virtue: it gives the salad its structure, the sensation of *something to chew against*, where a purely sweet-sour-crunchy dish would feel flabby. The chili and the raw garlic bring the sharp (TRPV1 and TRPA1), the herbs bring the cool, the nước chấm lays sweet-and-savory over the top, and the astringent green papaya is the plate the whole loud composition sits on. Nothing is cooked, so nothing is softened; the index reads this dish about as close to the raw plant as any in the book.

Because it is raw, a gỏi is also where our subtractive edits show most clearly. On a green, slightly bitter, slightly astringent vegetable we can turn either signal down at the source without cooking it out — a kohlrabi or a radish grown with its bitterness attenuated (the IFI-B lever of Chapter 12) arrives sweeter and cleaner into a raw salad than any amount of sugar in the dressing could fake. But we are careful here: astringency in a gỏi is wanted, so we leave it. The discipline of an engineered pantry is knowing which signals to lift, which to lower, and which — like the green grip of papaya — to simply let be.

Gỏi Đu Đủ — Green Papaya Salad

Serves 4 · 20 minutes · the loudest bright thing on the table

You need

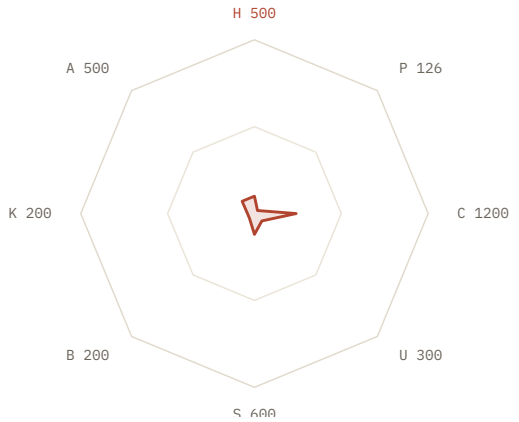
1	small	green papaya, shredded (or green mango, for a sharper gỏi)
1		carrot, shredded
2	tbsp	nước chấm (Chapter 1), sharpened with an extra squeeze of lime
		Thai basil, mint, rau răm; roasted peanuts; fried shallot
1		chili, to taste

Make it

1. Toss the papaya and carrot with the sharpened nước chấm and let them sit five minutes to drink it in and soften just slightly — the salt draws a little water, the shreds go from brittle to pliant, and the dressing climbs inside them.
2. Fold in a lot of torn herbs. Top with peanuts, fried shallot, and chili at the table, so the crunch stays crunch and the herbs stay bright.

Why it works — Raw and loud, the salad reads almost exactly as its plants do, which is the whole reason to eat it: the astringent papaya (IFI-A) gives the backbone, the raw garlic and chili the pungent-hot edge, the herbs the cool, and the dressing the sweet-savory frame. Five axes on one plate, none of them cooked into another, every one still wearing the face of the plant it came from.

IFI PROFILE



IFI-H	500
IFI-P	126
IFI-C	1,200
IFI-U	300
IFI-S	600
IFI-B	200
IFI-K	200
IFI-A	500

Chapter 9 · Canh Chua — *the sour soup.*

Across from the dark kho, on the same table, there is almost always a bowl of something bright and sour and barely cooked — canh, the everyday soup that resets the palate between richer bites. Its most beloved form is canh chua: tamarind-sour, scattered with pineapple and tomato and herbs, loud with fresh aromatics thrown in at the very last second so they stay alive. It is a hot soup that somehow tastes cooling, and it is how a Vietnamese meal breathes.



Tomato — with the umami bred out by a century of shipping-first selection, then grown back through the plant's own pathway.

The sour is tamarind — the tartaric and the characteristic tamarind acids — and acid is a taste the index leaves to the cook, read on the sour-sensing channels and not on our eight. But under the sour we grow the savory that keeps the soup from being merely sharp, and this is the tomato's story, which is the clearest single case in the whole library of what engineering a flavor actually means. A century of breeding tomatoes to ship — to redden on a truck, to resist bruising, to hold on a shelf — quietly bred the flavor out, and the losses were measurable: a modern commodial tomato can carry a small fraction of the free glutamate and the volatile aromatics of an heirloom. We did not add anything foreign to put it back. We restored the plant's own glutamate route — principally the glutamate-decarboxylase and glutamate-dehydrogenase steps that govern the free-glutamate pool in the ripening fruit — through the tomato line's **2,040 constructs**, designed to lift IFI-U from the low scores of a commodity fruit back toward where the plant's own biology can take it. The restored tomato is a real plant in our working library; a sour soup with real umami underneath tastes *complete*, and a sour soup without it tastes like a mistake, like sourness with nothing to pull against.

There is a frontier here too, for the imaginative cook. The roadmap holds a tomato that goes further — the *Volcanic* line (Ember, Magma, Pyroclast, Caldera, Krakatoa), a Solanaceae-core concept that would carry engineered heat in the fruit itself, so that a canh chua could take its chili from the tomato rather than the garnish. That is a "what could be built," not a "what is"; we flag the difference every

time, because the line between the grown and the imagined is one we keep bright. For today's soup, the restored tomato and a fresh chili do the work.

Canh Chua Chay — Sweet-and-Sour Soup

Serves 4 · 25 minutes · the bowl that lets the meal breathe

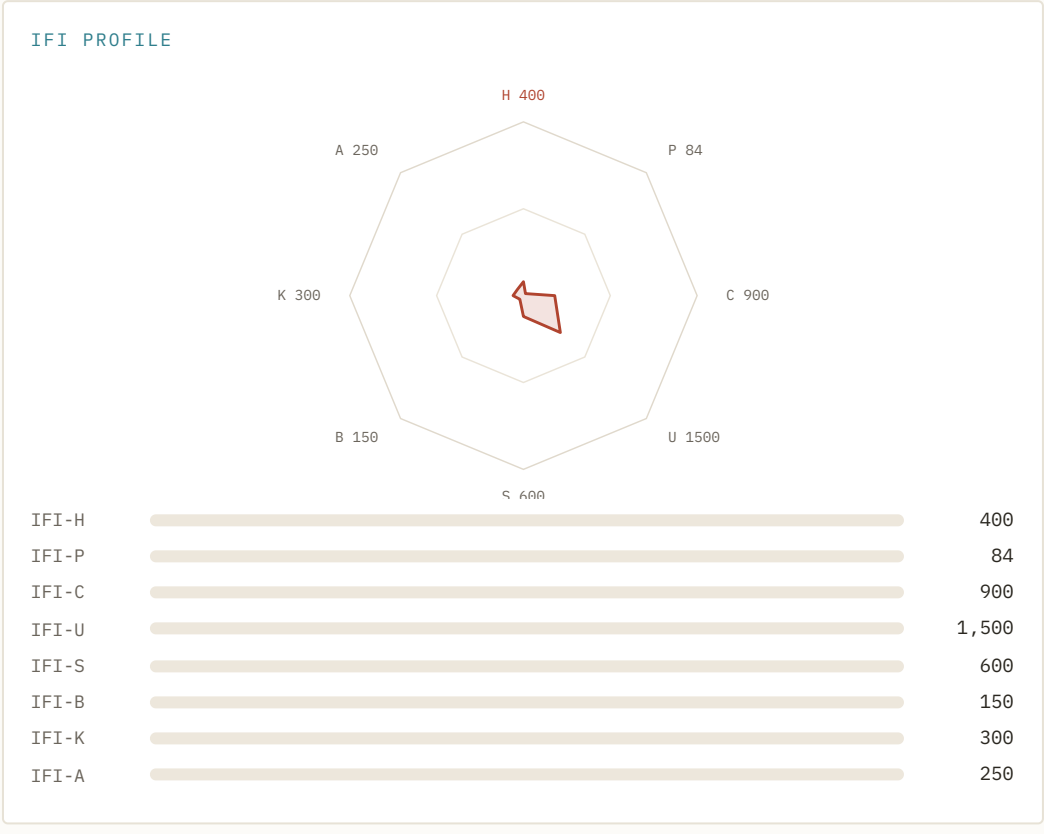
You need

2	tbsp	tamarind paste, loosened in hot water and strained
2		umami-restored tomatoes, in wedges
1	cup	pineapple, in chunks
2		taro or celery stems, sliced on the bias
1	cup	bean sprouts
2	tbsp	soy garum · 1 tsp sugarcane syrup
		a few okra, a chili, and to finish: ngò gai (sawtooth herb), rau om (rice-paddy herb)

Make it

1. Bring 6 cups (1.4 L) water to a simmer with the tamarind, soy garum, and sugarcane syrup. Taste for the sour-sweet-savory triangle and adjust — this base is the whole soup, and it should already taste balanced before a vegetable goes in.
2. Add the tomato, pineapple, taro or celery stem, and okra. Simmer just until tender — minutes, not longer. The pineapple is doing double duty, sweet and faintly acidic, bridging the tamarind and the tomato.
3. Off the heat, add the bean sprouts and a storm of torn herbs. They should wilt in the residual heat, never cook. Chili to taste.

Why it works — The soup is built on a tension the index reads clearly: tamarind's sourness pulling one way, the restored-tomato umami anchoring the other, a little sweetness holding the middle. Light as it is, it is not thin, because the savory floor is grown in rather than simmered from bones. The herbs at the very end bring the cooling top note on TRPM8 — the reason a hot soup can taste like relief.



Nourishment note, quiet: a soup like this is almost all water and plant, cooked barely and briefly — the gentlest way a vegetable can arrive at a table, carrying nearly everything it grew with still intact.

We like that the engineering here is restorative: not a new flavor imposed, but an old one, bred away, grown back.



PART IV OF VI

Bright Heat

The capsaicin design, the heat ladder, and the bowls that carry the dial in the eater's hand

Chapter 10 · Bright Heat — *the sting that lifts, not levels.*

Vietnamese heat is placed, not poured. The chili comes to the table whole, or crushed into the sauce, or sliced across the top, and each eater builds their own warmth bite by bite. It is a cuisine that understood, long before our index made it explicit, something fundamental: heat is not a quality of a dish but a dial on it, and the kindest thing a cook can do is leave the dial in the eater's hand. This chapter is where we open the platform all the way up — because to leave heat in the eater's hand well, you have to be able to specify it exactly, and that is the one thing a designed chili lets you do.



Pepper in cross-section — the placental tissue, where the Pun1 acyltransferase builds capsaicin molecule by molecule.

The science of the burn is the science of a single channel being told a true thing in an extravagant language. Capsaicin binds a pocket in the transmembrane domain of TRPV1 and lowers the channel's activation threshold; the body reads fire where there is none and answers with blood, breath, sweat, and the small endorphin lift that keeps you reaching for the next bite. Nothing is harmed. What we design is not *whether* that happens but the *shape* of it — where the warmth lands, how fast it blooms, how cleanly it leaves — and the shape is written in the chemistry of the molecule.

Capsaicin is made in the placental tissue of the pepper fruit by a biosynthetic route we have mapped and tuned end to end. Two branches converge. On the phenylpropanoid side, phenylalanine is carried by **PAL → C4H → 4CL** and onward through the pathway to vanillin, and then **pAMT** (an aminotransferase) converts vanillin to vanillylamine. On the fatty-acid side, branched-chain amino acids (valine, leucine) are carried by **BCAT** and elongated by the ketoacyl synthase **KAS** into an 8-methyl branched-chain acyl-CoA. The capsaicin synthase **Pun1/CS** (the AT3 acyltransferase) condenses the two — vanillylamine plus 8-methylnonenoyl-CoA — into capsaicin. The *length and saturation* of that acyl chain set the ratio of capsaicin to dihydrocapsaicin, and that ratio is the shape of the burn: a brighter, faster, front-of-mouth sting, or a deeper, slower, back-of-throat heat. Vietnamese cooking almost always wants the former, and it is a thing we can dial at the acyl-chain step.

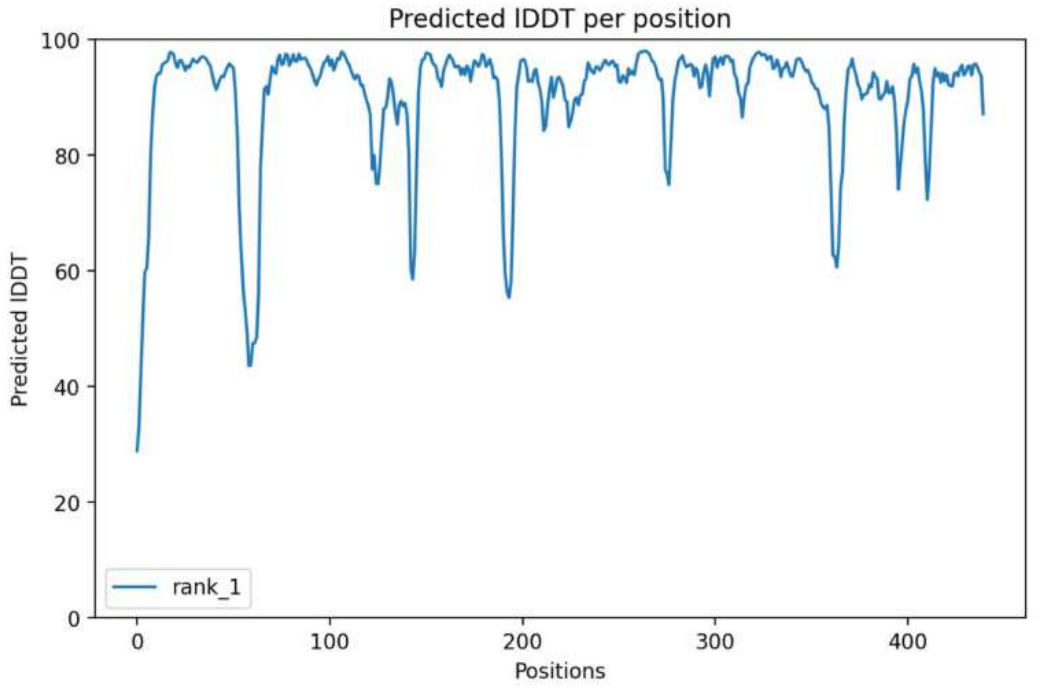


FIG. 10 — the Pun1/AT3 model coloured by pLDDT confidence; the binding domain and active-site cleft resolve high, which is where our edits land.

Every prior breeding program chased heat by selecting the hottest phenotype and hoping the genotype followed. We inverted it. A 650-million-parameter protein language model (an ESM2-class model) scored every possible single-residue substitution in Pun1 by its predicted effect on catalytic efficiency and fold stability. Our genome-scale flux-balance model predicts that control sits upstream in the phenylpropanoid pathway — at 4CL and HCT/CCoAOMT — not at the terminal Pun1/AT3 step; Pun1 is the final capsaicin synthase and labels the product, it does not govern the rate. Improving Pun1's catalytic geometry still shapes the burn profile — the capsaicin-to-dihydrocapsaicin ratio and the precision of that ratio across batches — and two substitutions emerged from the protein-language-model scoring:

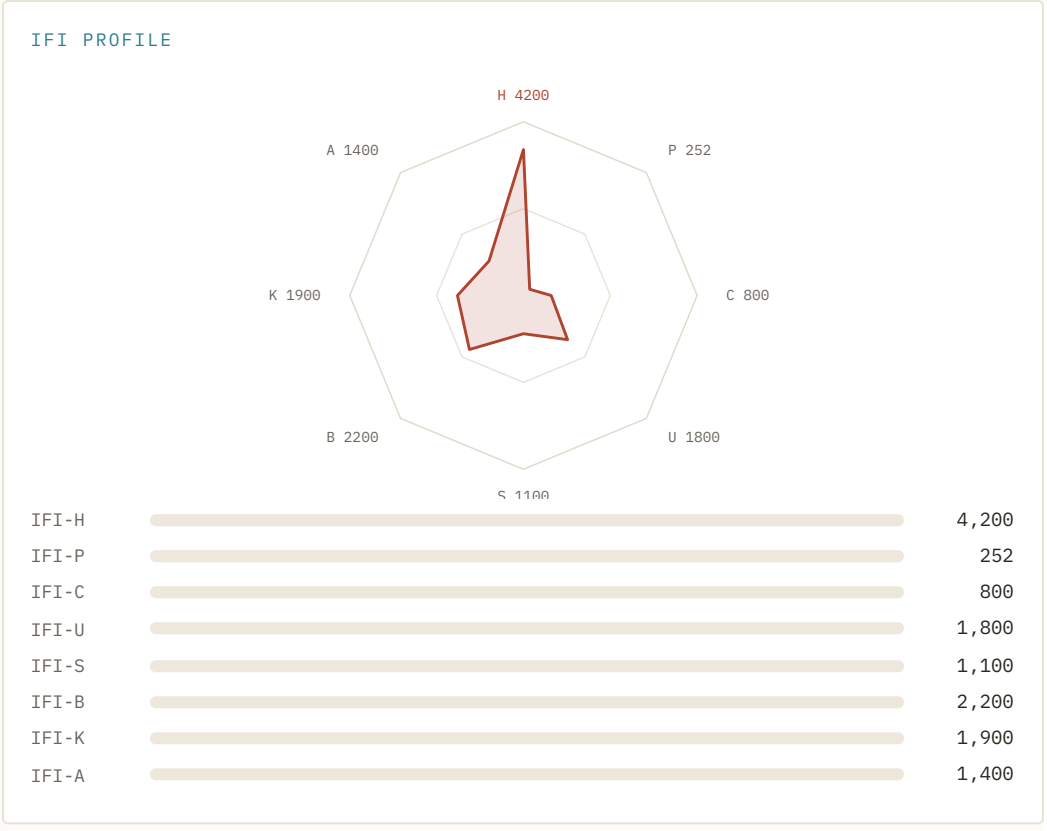
EDIT	EFFECT	ΔΔG (KCAL/MOL)
S39L	binding affinity ↑ (N-terminal)	−2.1
L345G	steric relief at the active-site cleft	−1.8
C175S	*structural annotation: disulfide-misfold prevention — not in shipped construct*	*−0.9*

The shipped construct is the double variant **S39L+L345G**. Together these shape the burn profile, and our model predicts peak capsaicinoid output in Phoenix of approximately **2.95 million SHU** at a designed batch-to-batch coefficient of variation of **7% or less**, against the 42% CV that is normal for a conventionally bred hot pepper. The consistency is the quiet revolution. A chili you can specify to within a few percent, batch after batch, is a chili a cook can actually compose with — the difference between "add a hot pepper and hope" and "add 600 units of heat, placed on top."

Our model predicts that across our proof-of-concept cultivars, the Scoville number and the IFI score rise together up a ladder of increasing computational design scope and axis activation. SHU is a dilution assay of total capsaicinoid concentration; IFI-H is anchored to receptor half-activation. Every rung is a designed cultivar, and the predicted values below are computational estimates:

CULTIVAR	SKU	PREDICTED SHU	IFI-H	AXES EXPRESSED
Ember	SS-0087	~866K	1,570	2/8
Cinder	SS-0088	~1.05M	2,290	3/8
Kindle	SS-0089	~1.25M	2,000	3/8
Flare	SS-0090	~1.48M	—	4/8
Blaze	SS-0091	~1.72M	2,630	4/8
Wildfire	SS-0092	~1.96M	2,930	5/8
Scorch	SS-0093	~2.21M	3,220	5/8
Firestorm	SS-0094	~2.47M	3,490	6/8
Solara	SS-0095	~2.72M	3,980	6/8
Phoenix	**SS-0096**	**~2.95M**	**4,200**	**8/8 (full spectrum)**

A Vietnamese table will almost never climb past the first rung — this cuisine borrows a table of bird's-eye brightness, somewhere near IFI-H 600, and leaves the superhots to the chiliheads. But the point of a ladder is that you can stand on any rung, and at the very top sits the one cultivar we designed to register on all eight axes at once, proof that even heat this far past reason can be designed to carry company rather than merely punish:



For the actual table, heat arrives as a condiment, and the most useful one to make is a Vietnamese chili-garlic sauce — tương ớt — or its oil-based cousin, sa tế. Here the designed chili pays off precisely because it is placed, not poured.

Tương Ớt — Chili-Garlic Sauce

Makes 1 jar · 20 minutes plus a day to meld · the dial, bottled

You need

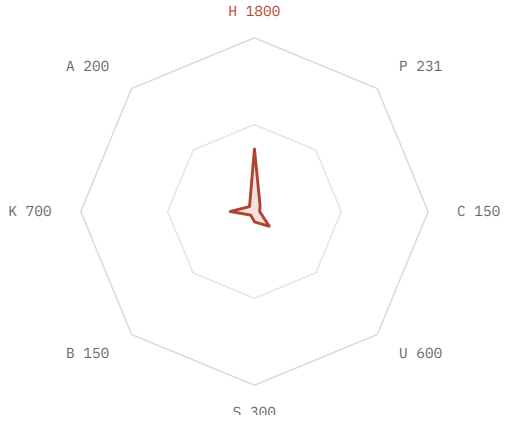
200 g		fresh red chilies, stemmed (choose the heat you want; a bird's-eye base reads bright and low, near IFI-H 600)
6	cloves	garlic
2	tbsp	rice vinegar
1	tbsp	sugarcane syrup
1	tbsp	soy garum
1	tsp	salt

Make it

1. Blitz the chilies and garlic coarse. Warm them gently in a dry or barely-oiled pan for a few minutes to take off the raw edge and start the color blooming.
2. Add the vinegar, sugarcane syrup, soy garum, and salt. Simmer five minutes to a loose, glossy sauce. Cool and jar; it is better the next day and keeps for weeks.
3. Use it the Vietnamese way — a dab at the edge of the bowl, built into each bite by the eater, never stirred through the whole dish for them.

Why it works — The sauce is the dial made physical. The capsaicin lands bright on TRPV1, the raw-then-cooked garlic lays a pungent edge on TRPA1, the vinegar and sugarcane frame it sour-sweet, and the soy garum gives it a savory floor so it reads as a *sauce* and not just heat. Build it on a designed chili and the one number that usually wanders most — how hot, exactly — stops wandering.

IFI PROFILE



IFI-H	1,800
IFI-P	231
IFI-C	150
IFI-U	600
IFI-S	300
IFI-B	150
IFI-K	700
IFI-A	200

A note on how we hold it: heat, to us, is a pleasure, never an assault — and this cuisine agrees, which is why it answers every chili with a leaf of mint. Even at the top of the ladder we design for the shape of the burn, because a heat you can taste through is a heat that belongs at a table, not one that only tests you.

Chapter 11 · Bún — *a bowl in balance.*

If phở is a meditation on one broth, bún is a conversation among many things in a single bowl. Cool rice vermicelli at the bottom; something smoky and grilled on top; a fist of raw herbs; a tangle of pickled carrot and daikon; crushed peanuts; and nước chấm poured over the whole thing to pull it together. Nothing is cooked into anything else. Every element keeps its own voice, and you taste them in shifting combinations spoon to spoon. Bún is the cuisine's clearest argument that composition, not reduction, is the way to hold many flavors at once.



Rice — the vermicelli that is the cool, neutral floor a bún is built up from.

This is multi-axis design at the scale of a bowl, and it maps almost exactly onto the problem our platform solves in silico. A naïve cook stacks strong flavors and they muddle — everything turns brown and savory and indistinct, the way an over-reduced sauce loses its edges. A Vietnamese bowl does the opposite: it keeps each axis *on a different physical element*, so they stay legible. The grilled topping carries umami and kokumi; the herb plate carries cool; the pickle carries sour and a tuned-down bitter; the sauce lays sweet-and-hot across the top; the vermicelli stays neutral underneath to let the rest read. No axis dominates because no two loud axes share an ingredient — which is, almost precisely, the constraint a flux-balance model imposes when it designs a multi-axis cultivar: distribute the load so that raising one signal does not have to come at the cost of another. The bowl solves by hand what the model solves by matrix.

Bún Chả Chay — Grilled Lemongrass Mushroom Bowl

Serves 4 · 40 minutes · the bowl that taught us about layering

Lemongrass and chili, pounded to a paste and worked into king oyster mushrooms, char on the grill into something meaty and deep; everything else on the plate stays cool and raw to meet it. Grill real pork the same way if your table eats it — the method and the balance are identical, and we mean that as respect, not apology.

You need

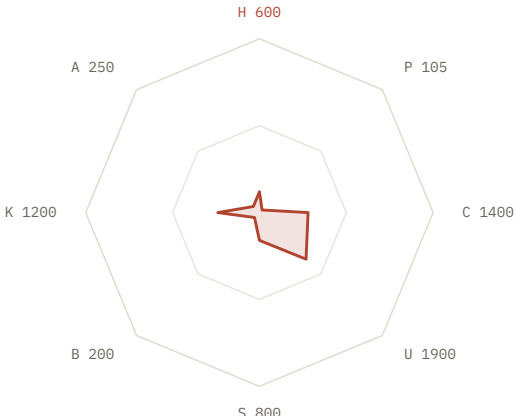
```
500 g      king oyster mushrooms, torn in thick strips
3   stalks lemongrass, minced fine
3   cloves garlic
1          chili
2   tbsp   soy garum
1   tbsp   engineered sugarcane syrup
           rice vermicelli (bún); nước chấm (Chapter 1);
           đồ chua (Chapter 12); mint, cilantro, lettuce; peanuts
```

Make it

1. Pound the lemongrass, garlic, and chili to a rough paste. Work in the soy garum and sugarcane syrup, then the mushrooms. Let them sit 20 minutes to take the marinade.
2. Grill or sear the mushrooms hard until the edges blacken and the sugars caramelize — this char is where the depth comes from, so do not crowd the pan; give each piece room to brown rather than steam.
3. Build each bowl cool: vermicelli, herbs, a pinch of đồ chua. Lay the hot mushrooms over. Flood with nước chấm, scatter peanuts, and eat by pulling a little of everything into each bite.

Why it works — The bowl is a live demonstration of composition. The grilled mushroom runs deep on umami and kokumi (glutamate plus the Maillard products of the char); the sauce lays heat and sweet across the top; the herbs answer with cooling; the pickle cuts it all with sour and a tuned-down bitterness. Each axis sits on a different element, so five of them coexist in one bowl without turning to mud — the trick the whole cuisine runs on.

IFI PROFILE



IFI-H	600
IFI-P	105
IFI-C	1,400
IFI-U	1,900
IFI-S	800
IFI-B	200
IFI-K	1,200
IFI-A	250

Chapter 12 · Bánh Mì & Đồ Chua — *brightness you can bite.*

The bánh mì is what happens when a cuisine takes a thing it was handed — a French colonial baguette — and makes it so completely its own that the origin becomes a footnote. Airy bread, a smear of something rich, cool herbs, chili, and the bright crunch of đồ chua, the pickled carrot and daikon that cuts through all of it. It is a whole Vietnamese meal folded into bread, and the pickle is what makes it sing. The pickle is also where the subtractive side of our platform — the quietest and, we think, the kindest edit on the index — does its clearest work.



Radish, the daikon's close kin — a Brassica-family root whose faint bitterness we can turn down at the source rather than hide under sugar.

Daikon carries a bitterness most people never quite taste, because the pickle hides it under sour and sweet. We would rather tune it than hide it. Bitterness is TAS2R38 and its sibling TAS2R receptors, the family evolution built as a poison-warning system; in a Brassica-family root like daikon, radish, or the mustards, the bitter and sharp notes come largely from glucosinolates and the isothiocyanates they release when the tissue is cut. The Zero-Bitter axis, IFI-B, is our subtractive lever: by rerouting glucosinolate biosynthesis and down-regulating the specific precursors that trip TAS2R38, our model predicts attenuation of the bitter signal by **20 to 65 percent** — without touching the plant's body, its crunch, or the compounds that are not bitter. Radish sits in the library at **40 constructs** on exactly this lever (with cabbage, kale, and broccoli, the **380**-construct Brassica flagship, alongside it).

Why subtract rather than mask? Because masking costs you. The traditional pickle drowns the daikon's bitterness in sugar and vinegar, which works, but it means the sweetness and the sour are spending themselves on concealment instead of contrast. Turn the bitterness down at the source and the sweetness and the acid are freed to do their real job — to be a bright, clean, crisp foil to the rich spread — rather than a cover-up. The crunch stops being a disguise and becomes the whole point. It is the same philosophy as the

restored tomato, run in the other direction: there we grew a wanted flavor back, here we grow an unwanted one down, and both are in service of letting the dish taste like itself.

Đồ Chua, and a Bánh Mì to Put It On

Pickle: 1 jar, 1 hour · Sandwich: 10 minutes · the brightest bite in the book

You need

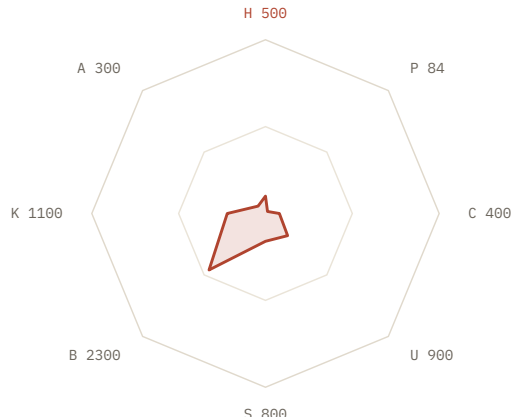
```
For the đồ chua:
1   large  daikon, julienned (low-bitter, if you grow it)
2          carrots, julienned
1   tsp    salt
3   tbsp   sugar
4   tbsp   rice vinegar · warm water to cover
For each bánh mì:
1          airy baguette
            pâté or mashed white bean whipped with garlic; mayonnaise
            cucumber, cilantro, sliced chili, a few drops of soy garum
```

Make it

1. Toss the daikon and carrot with the salt; wait 15 minutes, then squeeze out the water. This osmotic draw is what keeps the pickle crisp — it pulls free water out of the cells before the vinegar goes in, so the shreds stay snappy instead of going limp. Dissolve the sugar in the vinegar and warm water, pour over, and leave an hour (or weeks, refrigerated).
2. Split and lightly toast the baguette — the contrast of shatter-crisp crust and airy crumb is structural, not incidental.
3. Spread something rich on the bottom (pâté, or the mashed white bean), mayonnaise on top. Layer cucumber, a generous pinch of drained đồ chua, cilantro, and chili. A few drops of soy garum. Press it shut and eat standing up.

Why it works — The pickle is doing axis work, and its whole job is contrast: a bright, crisp, sour-sweet foil to the rich spread. But contrast only lands if the pickle itself is clean. Our design targets a 20 to 65 percent reduction in the daikon's bitterness at the source — rerouted glucosinolates, IFI-B — and the sweetness and the sour step into the space it leaves. What you taste is brightness, not a bitterness being papered over.

IFI PROFILE



IFI-H	500
IFI-P	84
IFI-C	400
IFI-U	900
IFI-S	800
IFI-B	2,300
IFI-K	1,100
IFI-A	300



PART V OF VI

The Sweet, the Bitter, the Cooling Glass

Cà phê · nước mát · chè · sinh tố — the drinks and desserts, where sweetness and coolness are the same gesture: relief

Chapter 13 · Cà Phê Sữa Đá — *bitter, tamed and poured over ice.*

Vietnam runs on coffee, and not the mild kind. The bean here is robusta — darker, stronger, nearly twice the caffeine and far more bitter than the arabica the specialty world prefers — dripped slow through a little metal phin over a pool of sweetened condensed milk, then poured, the whole intense sweet-bitter thing, over a glass of ice. Cà phê sữa đá is a study in two axes pulling hard against each other, bitterness and sweetness held at a tension most drinks would never risk, and it is the clearest place in the book to meet the Zero-Bitter axis in a cup rather than on a root.



Coffee, in cross-section — robusta's bitterness is chlorogenic acids and caffeine, and we can soften the warning without touching the soul of the cup.

Bitterness in coffee is not one molecule but a committee. Caffeine contributes some. The larger share, especially in a dark robusta, comes from the chlorogenic acids and, on roasting, their breakdown products — the chlorogenic acid lactones at a medium roast, and the phenylindanes that form as the roast goes dark, which are the harsh, lingering bitterness of a strong cup. All of them read on the TAS2R family, TAS2R38 chief among them, the same warning system the daikon tripped. Traditionally the condensed milk is there to shout the warning down with sugar and fat.

We would rather turn the warning down than bury it. The coffee line (**40 constructs**) works the Zero-Bitter lever on the bean itself — our model predicts attenuation of the bitter precursor load by 20 to 65 percent — so that less of the bitter signal reaches TAS2R38 in the first place. Crucially, this is a *selective* subtraction: it leaves the caffeine (and thus the lift that is half the reason anyone drinks robusta), it leaves the body, and it leaves the deep roasted aromatics. What it removes is the specific harsh bitterness that used to drown the bean's own chocolate and caramel notes — so those come forward, and the condensed milk becomes a partner rather than a rescue. Less sugar needed; more coffee tasted.

Cà Phê Sữa Đá

Makes 1 · 5 minutes plus the drip · the most beloved bitter in the country

You need

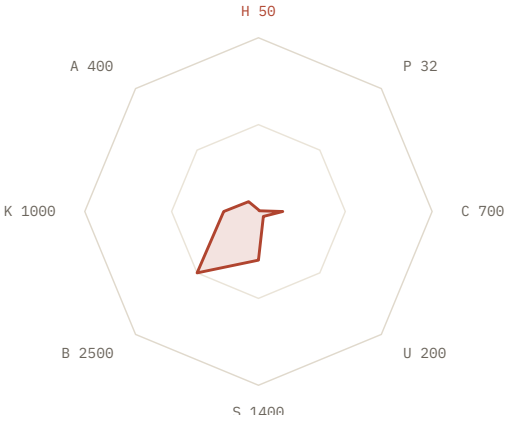
2	tbsp	coffee, dark robusta (low-bitter, if you have it), coarse
2	tbsp	sweetened condensed milk
		a full glass of ice

Make it

1. Spoon the condensed milk into the bottom of a glass. Set the phin on top, add the coffee, and press the filter gently down.
2. Pour in just-off-boil water to the brim and let it drip — slow, four or five minutes, a small meditation. The slow drip is a long extraction, which pulls more body and, in a conventional bean, more bitterness; on a low-bitter bean you get the body without the bite.
3. Stir the dark coffee into the milk until it turns the color of caramel, then pour the whole thing over a glass packed with ice. Stir again, hard, until frost beads the glass.

Why it works — The drink is a two-axis composition: bitter against sweet, with the ice adding a literal coolness the index reads on TRPM8. Pull the bitterness down at the bean — fewer bitter compounds reaching TAS2R38 — and the balance no longer depends on drowning the coffee in sugar. What you taste is the bean, finally, all the way down, and the sweetness is free to be flavor instead of defense.

IFI PROFILE



IFI-H	50
IFI-P	32
IFI-C	700
IFI-U	200
IFI-S	1,400
IFI-B	2,500
IFI-K	1,000
IFI-A	400

For the curious: cà phê trứng, egg coffee, runs the same bitter-sweet tension through a whipped cloud of egg yolk and condensed milk instead of ice — the yolk's fat and lecithin carry a kokumi roundness (CaSR) that makes the bitterness read even gentler. Same bean, same principle, a different way of answering the warning.

Chapter 14 · Nước Mát & Chè — *cooling, by design.*

In a hot country, the sweet things are the cooling things. Nước mát — "cool water" — is a whole family of herbal drinks taken to bring the body down; nước mía is sugarcane crushed fresh over ice; chè is the sweet soup, beans and jelly and fruit in coconut milk, somewhere between a drink and a dessert, always served cold. Sweetness and coolness are the same gesture here: relief. And sweetness is the axis we tune most gently of all, because it reaches furthest into the body, and because the index lets us do something here that borders on the magical — move the *taste* of sweet almost entirely free of the sugar that usually carries it.



Coconut — the cool, creamy base of chè, carrying a kokumi roundness under all that sweetness.

Sweetness is the TAS1R2·TAS1R3 heterodimer, a receptor with more than one way in. Sugars bind one site; but so do a remarkable range of non-sugar molecules, some of them thousands of times sweeter per gram, because sweetness is about *fitting the receptor*, not about being a carbohydrate. This is the whole basis of the sugar-free sweetness program:

SOURCE	LINE (CONSTRUCTS)	SWEET AGENT	NOTE
Stevia	910	steviol glycosides (stevioside, reb A)	clean, very potent, a faint edge at high dose
Monk fruit	80	mogrosides (mogroside V)	round, no bitterness, heat-stable
Sugarcane	200	native sugars, raised	real sugar, grown richer; for caramel and body
Brazzein / sweet proteins	(frontier)	protein ligands of T1R2·R3 (UniProt P56552)	sweetness from protein, nanomolar potency

The point for a Vietnamese drink is this: a cuisine that sips its sweetness all day in the heat — iced, constant, generous — is exactly the cuisine where moving the sweet signal off the sugar matters most. With stevia's steviol glycosides or monk fruit's mogrosides amplified at the source, the tongue hears *sweet* through T1R2·R3 while the body takes on almost none of the sugar to hear it. We do not make a health claim of that; we simply note what the

molecules do, and let a cook decide. For the body's own reasons, we think a glass that cools without a sugar load is a kind thing to be able to pour.

Nước Chanh Bạc Hà — Mint Limeade

Makes 2 · 5 minutes · the coolest glass in the book

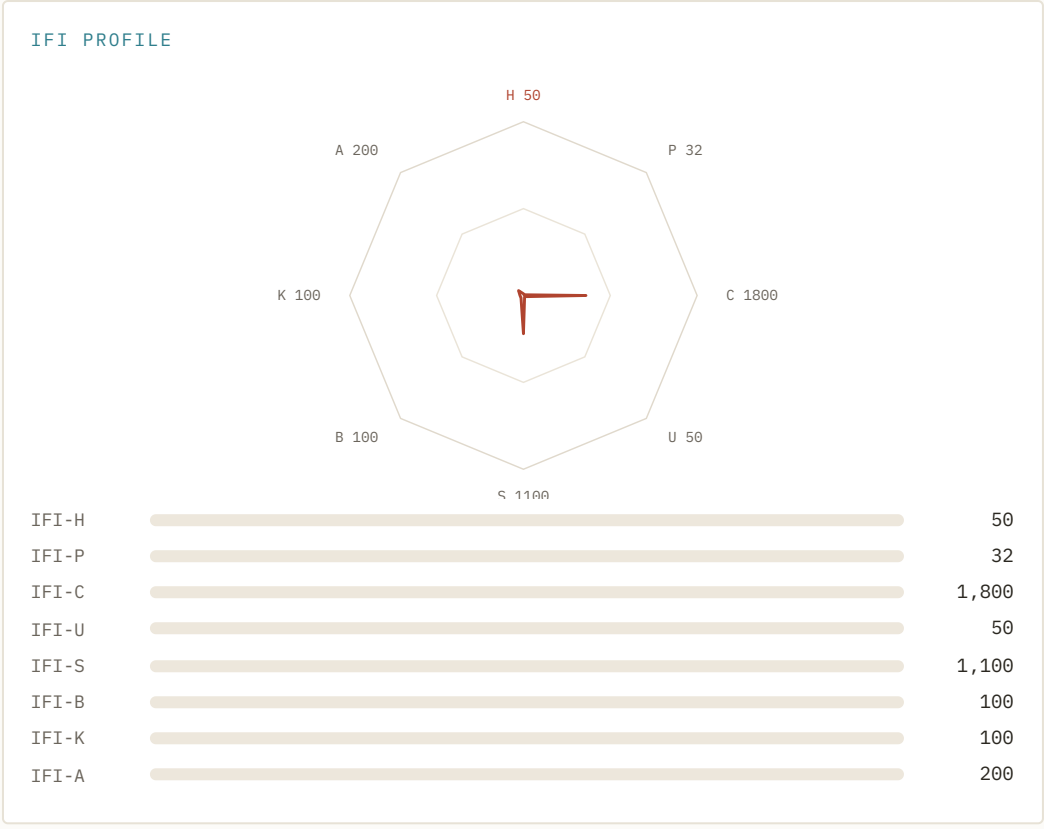
You need

```
3   tbsp   lime juice, fresh
2   tbsp   engineered sugarcane syrup (or stevia/monk-fruit syrup, to
taste)
            a generous handful of engineered mint, bruised
            soda or still water, over plenty of ice
```

Make it

1. Muddle the mint gently with the syrup — enough to bruise, never to shred, so it gives up its cool menthol and not the bitter chlorophyll of torn leaf.
2. Add the lime, top with water and ice, and drink it in the shade.

Why it works — The cool here is *engineered*, not borrowed from the ice. The menthol our peppermint line is designed to build (Chapter 2) lands on TRPM8 and keeps cooling long after the glass has stopped being cold — a sensation, not a temperature. The sweetness, moved onto cane or stevia, frames the lime without a heavy sugar load. A cold drink that stays cooling, sweet with a light hand: the glass the climate asks for.



Chè Đậu — Sweet Bean & Coconut

Serves 4 · 30 minutes · the cold sweet soup between a drink and a dessert

You need

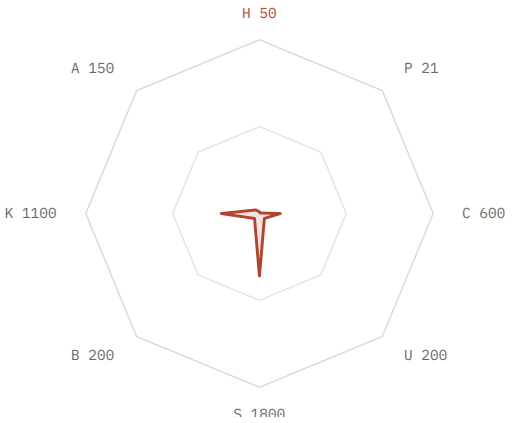
1	cup	mung beans or black-eyed peas, soaked and cooked soft
1	can	coconut milk
3	tbsp	monk-fruit or sugarcane syrup
		a pinch of salt
		pandan (a knotted leaf) if you have it
		tapioca pearls or grass jelly; crushed ice to serve

Make it

1. Warm the coconut milk with the syrup, salt, and pandan until just under a simmer — the salt is doing kokumi-adjacent work, lifting the perceived sweetness and roundness so you need less sweetener.
2. Fold in the cooked beans and the pearls or jelly. Cool completely.
3. Serve in glasses over crushed ice, the coconut poured last so it marbles through.

Why it works — Chè is sweetness and coolness and body all at once: the T1R2·R3 sweet (moved off sugar where you like), the literal cold, and the coconut's fat lending a kokumi roundness on CaSR that makes the whole thing taste richer than its sugar. A pinch of salt is the oldest sweetness-amplifier there is, and it earns its place here.

IFI PROFILE



IFI-H	50
IFI-P	21
IFI-C	600
IFI-U	200
IFI-S	1,800
IFI-B	200
IFI-K	1,100
IFI-A	150

Chapter 15 · Sinh Tố & the Fruit Frontier — *sweetness that grew that way.*

Sinh tố is the Vietnamese smoothie, and it is the most direct argument in the whole cuisine that the best sweetness is the kind a plant already made. Avocado whipped with milk and ice into something closer to a mousse than a drink; mango, soursop, jackfruit, lychee — fruit blended at the peak of ripeness, barely sweetened because it barely needs to be. Where chè builds sweetness and kho spends it, sinh tố simply *finds* it, already grown, and the engineering question it poses is the one furthest out on our roadmap: can we grow fruit that carries more of its own flavor — and, at the edge of the imagination, fruit that carries flavors it never had?



Mango — ripe-fruit sweetness and aroma, the kind a plant makes for itself and we would rather amplify than replace.

The near frontier is restorative and real, the tomato's story told in fruit: ripening is a program of sugar accumulation and volatile synthesis, and much of what a shipped fruit loses it lost because it was picked unripe to survive the truck. The far frontier is where the roadmap gets cinematic. Our 64-organism concept library — the "what could be built," always flagged as such — runs five tiers deep, and its most playful branch is the cross-family **Sweet Heat** line: a strawberry (the **T3** tier, 7–10 genes, 36–48 months on the concept timeline) designed to carry capsaicin-family warmth in a sweet fruit,

with cultivars named for exactly what they would be — *Warm Kiss, Sugar Burn, Candied Fang, Devil's Dessert*. A sinh tố made from a Candied Fang strawberry would carry its own heat, sweet and warm at once, the swicy intersection grown into a single fruit instead of composed in a blender.



Lychee — the cool, floral, high-sweet fruit of the far south, and a sinh tố that needs almost nothing added.

We keep the line between the grown and the imagined bright, always, because the whole credibility of an engineered kitchen rests on it. The restored tomato is on the bench and in the soil; the Candied Fang strawberry is on the roadmap and in the imagination. Both belong in a book like this — one as what you can cook tonight, the other as the horizon the cooking is walking toward. A sinh tố is a fine place to hold both in the hand at once.

Sinh Tố Bơ — Avocado Smoothie

Makes 2 · 5 minutes · the fruit that drinks like a dessert

You need

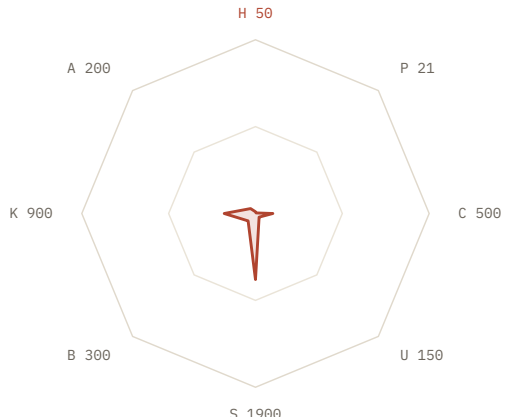
1		ripe avocado
1	cup	milk (dairy or soy)
2	tbsp	sweetened condensed milk, or monk-fruit syrup to taste
		a big handful of ice

Make it

1. Blend everything smooth and thick — it should fall slowly from the spoon, more spooned than sipped.
2. Taste and adjust the sweetness with a light hand; a ripe avocado brings its own buttery richness, and the point is to frame it, not bury it.

Why it works — The avocado is almost pure kokumi texture — fat and a mouth-coating roundness that reads on CaSR as body — and the drink is built to let that be the star, with just enough sweetness (moved onto monk fruit where you like) to frame it. It is the gentlest sweet in the book, and the one that leans hardest on the plant having already done the work.

IFI PROFILE



IFI-H		50
IFI-P		21
IFI-C		500
IFI-U		150
IFI-S		1,900
IFI-B		300
IFI-K		900
IFI-A		200



PART VI OF VI

The Whole Table

The composed meal, the precision beneath it, and the clean plate the whole cuisine has always set

Chapter 16 · The Composed Meal — *full-spectrum at the scale of a table.*

Step back from any single dish and look at a whole Vietnamese table, and you see the thing the cuisine has always known: the unit of balance is not the plate but the meal. The dark kho sits beside the bright canh chua; the rich grilled bún is answered by the cool fresh gỏi cuốn; every hot thing has its plate of herbs, every deep thing its sour, every sweetness its salt. No one dish tries to be everything. Together, they are — and that completeness, reached by arrangement rather than by any single intense food, is the oldest and in some ways the wisest version of what our whole platform does.



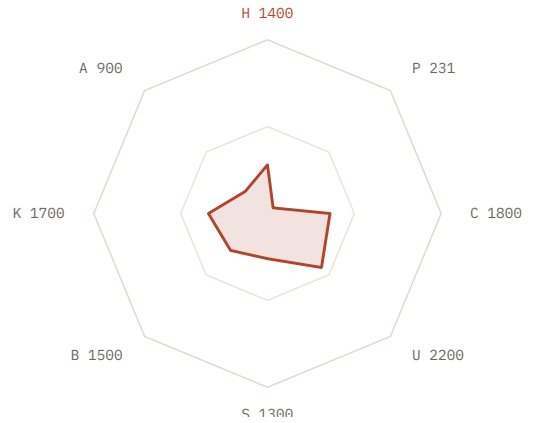
Phoenix, SS-0096 — the single fruit designed to register on all eight axes at once. A Vietnamese table reaches the same completeness a different way.

Our platform can design a single cultivar that is predicted to register across all eight axes at once. Phoenix — the full-spectrum flagship at the top of Chapter 10's ladder — is the proof it can be done in one fruit: heat, pungency, cool, umami, sweet, zero-bitter, kokumi, and astringency all present in a single plant, the triple-axis M3 and dual-axis M2 libraries (2,800 and 8,400 constructs) its working ancestors. A Vietnamese meal reaches the same eight-axis completeness by the opposite route: each dish strong on a few axes, the table balanced across all of them, the eater moving between bowls to tune their own experience bite by bite. Full-spectrum by composition rather than by concentration. Here is a whole meal, read as one object the way Phoenix is read as one fruit:

DISH	CARRIES (LOUD AXES)	ANSWERED BY
Phở chay	umami, kokumi	the herb plate's cool
Nấm kho	kokumi, deep umami	the canh chua's sour-bright
Canh chua	sour, umami, cool	the kho's dark depth
Gỏi cuốn	cool, fresh	the peanut dip's richness
Đồ chua	sour, zero-bitter	the rich spread it cuts
Tương ớt	heat, pungency	the whole table's green and sweet

Read across the whole table, the meal scores like a full-spectrum cultivar — no single axis dominant, every one present:

IFI PROFILE



IFI-H	1,400
IFI-P	231
IFI-C	1,800
IFI-U	2,200
IFI-S	1,300
IFI-B	1,500
IFI-K	1,700
IFI-A	900

That the cool axis reads highest is the reason we gave this book the cool accent. Of all the cuisines in this shelf, Vietnamese is the one that understood most deeply that heat is only ever half of a sentence — that the other half is a leaf of mint, a bowl of sour soup, a glass poured over ice. It holds TRPV1 and TRPM8 in the same breath, fire and its answer, and calls the balance between them dinner. Our instrument can finally write that balance down; the cuisine was keeping it by heart long before we arrived.

Chapter 17 · Precision & the Clean Plate — *the quiet discipline under all of it.*

Two things hold this whole book up, and neither of them is a flavor. The first is precision: the promise that a designed plant does the same thing twice. The second is restraint: the promise that we will tell you what a molecule does to a receptor and never what it does to your health. Both are disciplines rather than ingredients, and both are the reason an engineered kitchen can be trusted at a table.



The line, checked before it is ever grown out — reproducibility is a flavor decision as much as a manufacturing one.

Take precision first, because it is the less obvious of the two and the more revolutionary. A conventionally bred hot pepper varies wildly batch to batch — a coefficient of variation around **42%** is normal, which is why a recipe can only ever say "add a chili and taste." Every live cultivar in our library is designed to a CV of **7% or less**. That number is what makes everything in this book composable: a nước chấm you can specify, a heat you can place to IFI-H 600 and trust, a savory floor that arrives at the same depth every time. Consistency is not a manufacturing nicety here; it is the precondition for treating flavor as something you can *design* rather than merely *hope for*. The whole index — eight axes, each a number anchored to a receptor — would be meaningless pointing at a plant that read differently every harvest.

The scale behind that promise, stated plainly and from a single source so the numbers never drift: roughly **19,000 engineered constructs** across **42 host organisms**, of which **1,000 are live and purchasable** today, against a catalog of **78,800 total SKUs** of possible combinations; **8 sensory axes**; **≤7% batch CV** design specification; **3 patents filed**; and **21 peer-reviewed papers** released openly on Zenodo under CC BY 4.0. The organisms behind this one cuisine are a slice of that library — peppermint at 2,360 constructs, tomato at 2,040, garlic at 560, soybean at 360, tea at 280, yeast at 240, sugarcane at 200, ginger at 120, spearmint and shiitake and koji

mold at 80 each, coffee and onion and cassia and radish at 40 — every one designed on the same ruler, every one built to the same tolerance.

Now restraint, which is the more important of the two. Everything we have said about nourishment in this book — the clean broths, the raw plate, the sweetness moved off sugar, the bitterness we would rather tune than bury — we have said as a cook says it: as care and intention. We describe what a plant does on a receptor, which is physics and chemistry and measurable. We do not describe what it does for your body, which is not ours to claim. There are no cures in this book, no detox, no health halo — only plants designed to carry more of what makes them worth eating, and an honest account of how they speak to the tongue. The one surface in our whole library where nourishment becomes the explicit subject is a different shelf entirely; here it stays what it is in a Vietnamese kitchen, a quiet value humming under the cooking, never preached and never sold.

These are computational designs; Scoville Splice's cultivars and constructs have not been experimentally validated in a laboratory. That is the discipline that lets an engineered kitchen keep faith with an old table. Measure everything. Claim nothing you cannot show. Grow the plant to carry more, and then get out of the way and let the cook — and the eater, building their own bowl — finish it.

A closing grace · at a borrowed table

We wrote this book as guests, and we want to end it that way. We did not grow up at this table; we came to it with reverence, the way you come to anything that has quietly perfected something you spend your life trying to measure. What we brought was our instrument — a way to read the balance on eight axes, and plants designed to carry more of what makes the balance worth keeping: a mint that cools harder, a tomato with its umami grown back, a coffee with its bitterness gently turned down, a chili you can place to a number. What we were given in return was the lesson under the whole library — that flavor is not a single loud thing but many things held in care, and that the holding is the art.



The greenhouse at dusk — we grow the plants, and then we hand the balance to the table.

Cook these for people, the way this food is meant to be cooked — too much of it, in the middle of the table, everyone reaching. Carry out the herbs last, still wet. Let each person build their own bowl, their own heat, their own balance. That was always the point of measuring anything: not to fix a flavor in place, but to understand it well enough to set it free at the table, and let the people you love finish it themselves.