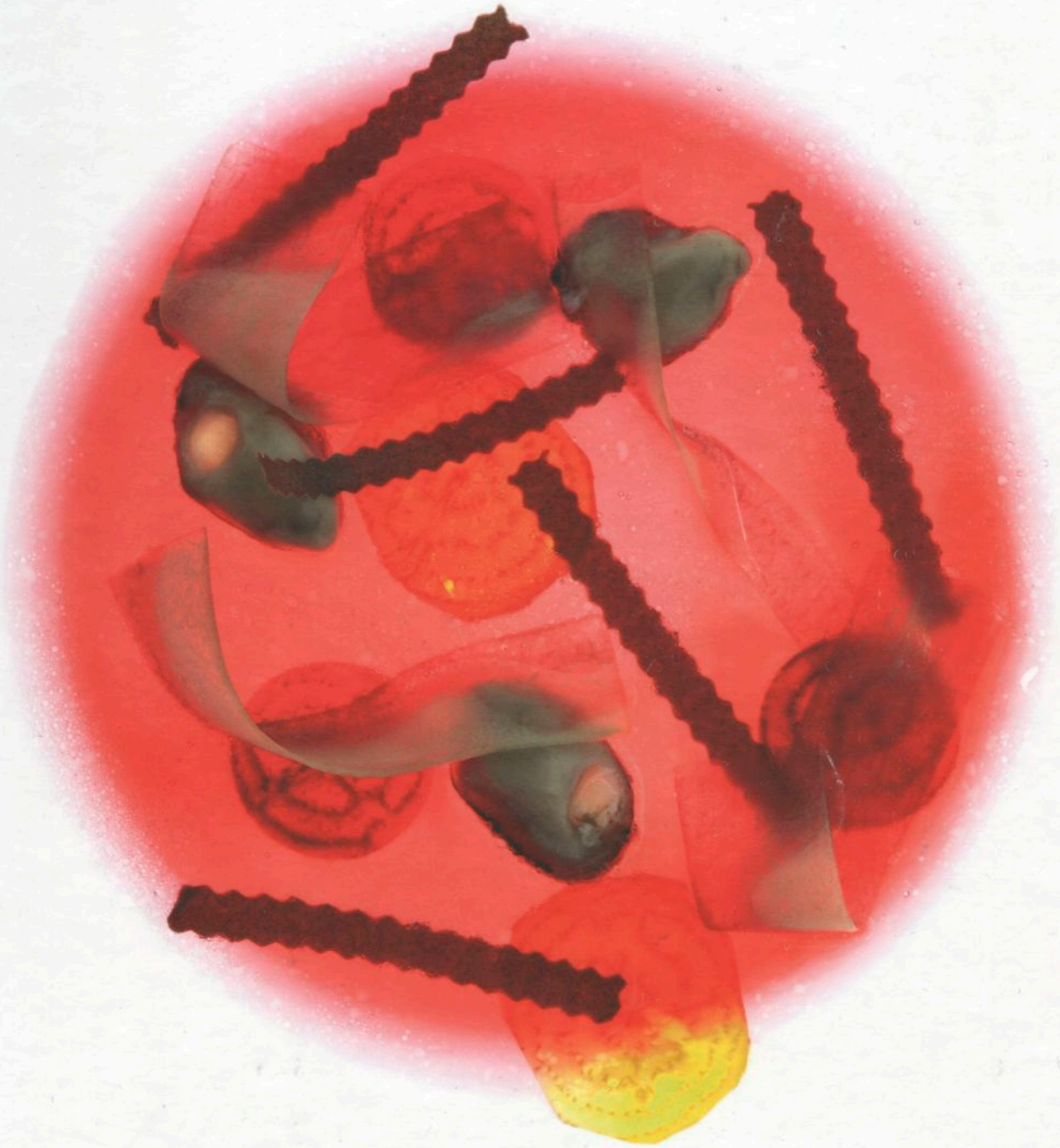
MODERNIST CUISINE



5 · Plated-Dish Recipes

Dried green peas

Red cabbage

MODERNIST CUISINE

The Art and Science of Cooking

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ISBN: 978-0-9827610-0-7
First edition, 2011

Library of Congress Cataloging-in-Publication Data available upon request

Printed in China

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Volume 5

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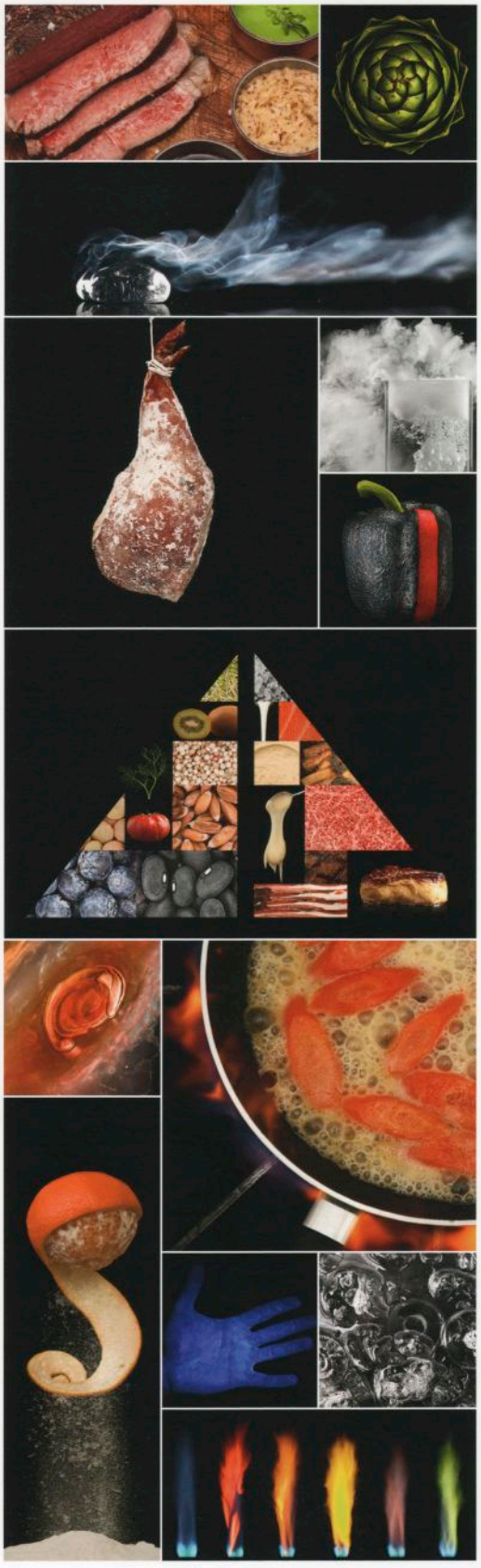
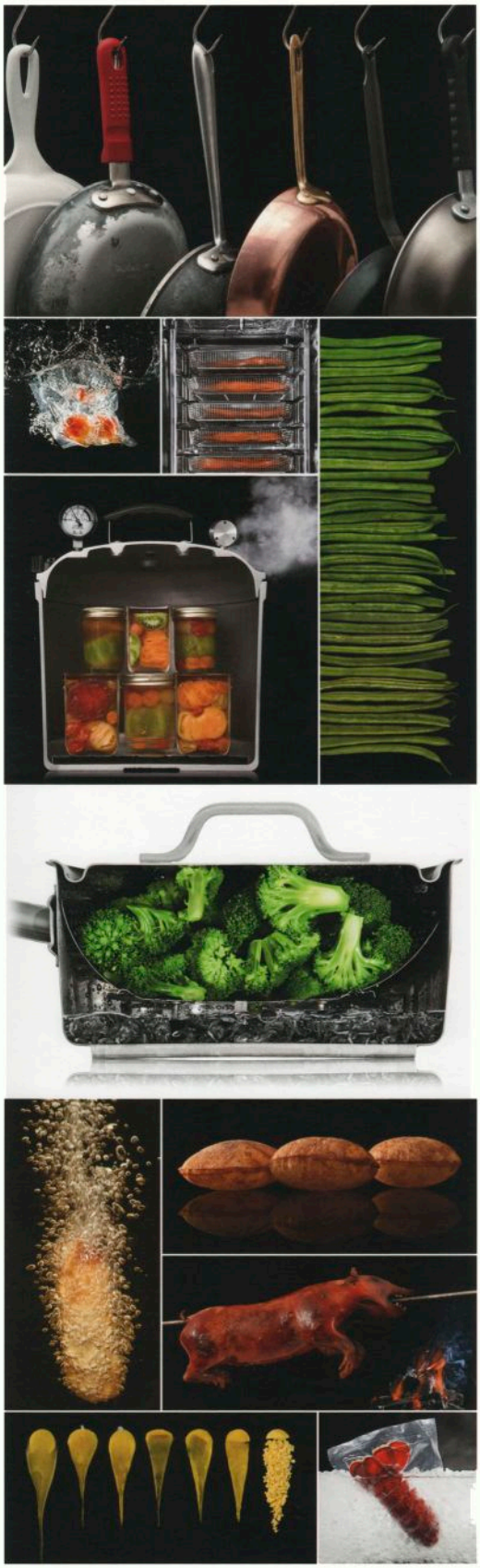
VOLUME 1: HISTORY AND FUNDAMENTALS



Page references of the form 4-381 refer to volume 4, page 381

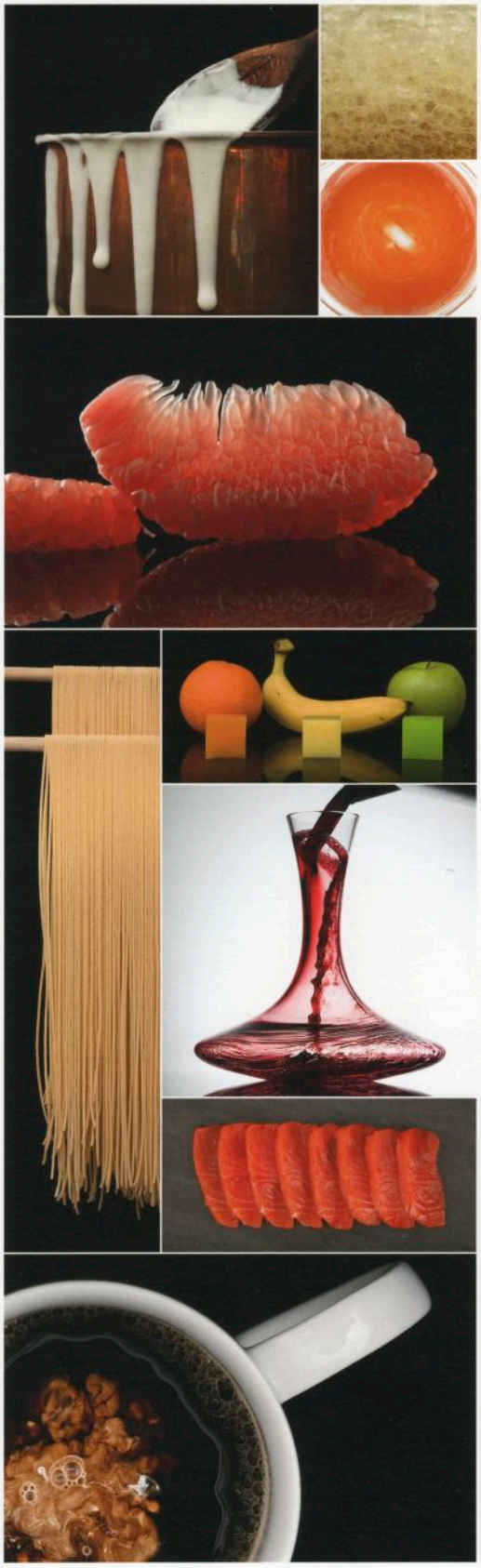


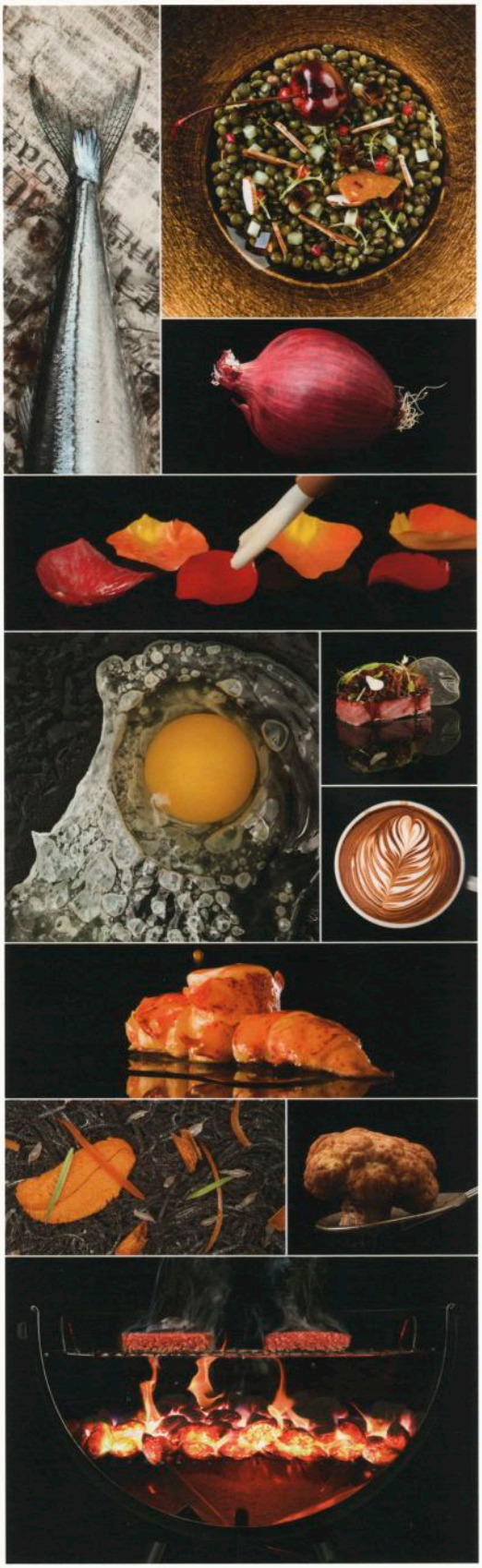
VOLUME 2: TECHNIQUES AND EQUIPMENT

VOLUME 3: ANIMALS AND PLANTS

VOLUME 4: INGREDIENTS AND PREPARATIONS

VOLUME 5: PLATED-DISH RECIPES





ABOUT THE RECIPES

This sections repeats, for the reader's convenience, material that appears in greater detail in volume 1 on page 1·93. In particular, example recipes and parametric recipes are discussed in volume 1 but not repeated here, where the focus is on the plated-dish recipes that appear in this volume.

Modernist Cuisine, both the culinary movement and this book, is dedicated to looking at cooking from new angles. This includes covering topics ignored by other culinary books. So it stands to reason that our recipes look somewhat different from those in other cookbooks. Our goal is to break down recipes in such a way that you can better understand not just the *what* (ingredients) and the *how* (methods), but also the *why*. To accomplish this, we needed a new format for presenting recipes.

The compact, modular form of our recipes makes them a broader resource for instruction and inspiration. They're meant to help you both understand the practical applications of culinary principles and visualize how you might apply those principles in other contexts.

In these five volumes, you'll find a huge variety of recipes and foods. Although we are telling the story of Modernist cuisine, our recipes are not limited to cutting-edge dishes—we cover everything from American regional barbecue to innovative flavored gels. The point is not to tout modern approaches or science for their own sake but to illustrate how the principles of Modernist cooking can be applied across a wide range of recipes.

An important thing to consider when following recipes in this book is that details matter, often to a great degree. In traditional cooking, there's a common precept that exact measurements don't matter much (at least in savory dishes): a handful of this, a few drizzles of that, a pinch of something else. Fundamentally, much of this kind of cooking is done "to taste," following the cook's experience.

That is not the case with pastry, where precision counts. You don't add yeast or baking powder to taste, and proportions of leavening to flour aren't left to creative impulse. Modernist cuisine tends to lean more toward the pastry chef's approach. In Modernist cooking, carefully measuring ingredients ensures consistent results.

In part, that is because the specialized ingredients used in this form of cuisine can be quite powerful. A little too much of a gelling agent, for example, can result in a tough, rubbery product, while too little will not produce the desired gelling effect. So measuring is a critical factor, at least if you'd like to attain the end result that we intended.

Ingredients and Equipment

You might be surprised to learn that although many people equate Modernist cooking with something akin to laboratory science, the majority of recipes here can be made with tools available in most standard kitchens. Even the recipes that involve sous vide techniques can be made without specialized gadgets; you can just use a simple pot on the stove and a thermometer (see page 2·240).

At the other end of the spectrum are the recipes that do require a centrifuge, combi oven, freeze dryer, or other specialized tool. If you're interested in investing in such equipment, there are many places to find it, from eBay and other purveyors of secondhand equipment to scientific-equipment catalogs and a growing number of cooking stores.

Very few kitchens on Earth have all the equipment featured in this book (I know of only two: one at my house and another at our cooking lab). Our recipes were designed under the assumption that the optimal tools and equipment are on hand. If you don't have those tools at your disposal, those particular recipes will be more informational than practical, but they will still serve their purpose as an educational medium. Indeed, many recipes in cookbooks end up functioning primarily to provide information and inspiration. Not everyone who owns a copy of Auguste Escoffier's *Le Guide Culinaire* has made all his triple stocks and complicated forcemeats, for example, but there remains great instructional value in seeing his examples and reading the recipes.

In a few cases, there may be local legal issues with some of the equipment we use. The state of Texas requires a permit to own laboratory glassware, for example, and distillation is regulated in the United States at both the federal and state levels. One piece of equipment we use in this book, the rotary evaporator, is made for distilling; if it is used to distill and concentrate alcohol, it may be subject to regulation.

What you won't find in our recipes is much attention to the most basic equipment, such as bowls and sauté pans. We presume that you'll know what equipment you need to use when we call for blending or simmering or sautéing.

Recipes here use a number of unusual ingredients, like xanthan gum, sodium alginate, gellan, essential oils, and glucono delta-lactone. Our glossary of cooking terms on page V describes each of these ingredients, many of which you can find in well-stocked supermarkets and health food stores. They are often sold as substitutes for more routine products. Some people with wheat allergies, for instance, use xanthan gum to replace the gluten protein found in wheat flour. Agar is often available

where you'd find other Asian specialty products. The rise of the Internet has made finding such items much easier, and they are available from a number of online stores. A list of sources is provided near the end of this volume, on page XXX.

Seeing things like propylene glycol alginate in an ingredient list may take some getting used to, but it should be no stranger than a meringue recipe that calls for cream of tartar, a quick bread recipe that calls for baking powder, or a recipe for a regional specialty that calls for distinctive herbs and spices.

Weights and Measures

You'll see in these recipes that we measure ingredients by weight. Most cookbooks distributed in America use U.S. weights and volumes for ingredients: ½ cup of sugar, one teaspoon of salt, two cups of milk, etc. We find that these volume measurements are not sufficiently accurate in many instances—0.1% more or less of certain gelling agents or thickeners, for example, (a mere extra gram per liter of liquid) can ruin some recipes. So rather than using more general volume measures in some cases and precise gram weights in others, we chose to use gram weights for all ingredients in the book.

We even list water by its weight rather than its volume, unless the quantity needed is undefined. Salt is usually relegated to the vague notion of "to taste," but where practical, we provide measurements for salt by weight. Obviously, if you like more or less salt, adding it to taste is always your prerogative, but we believe it's important to maintain as much precision as possible so that you will achieve the same textures and flavors that we did when developing these recipes.

A few exceptions include ingredients that come in distinct units, such as eggs or allspice berries. We usually still measure these by weight, but we also list the rough equivalent units for reference. And some ingredients are called for "as needed," when there simply is no single correct amount to use.

Digital gram scales are widely available in cooking stores around the world. They're common enough now that a good basic model is not an expensive investment. If you've measured ingredients only by the cup and teaspoon until now, this is a great time to buy a good scale and begin applying a bit more precision to your recipe measurements.

In fact, you might want to consider getting two different scales if you're committed to cooking a range of recipes from this book. One would be your general-purpose scale, good for measuring weights from one gram to 1,000 grams or more. The second scale would be for finer measurements, accurately weighing items down to 0.01 gram. Such scales often max out at 100 grams or so and thus are not as widely applicable as the first type of scale.

Keep in mind that the final yield of a recipe will not necessarily be a simple sum of the weights of the ingredients. Some things get trimmed along the way, liquids evaporate, and unmeasured ingredients come into play. We provide yield information based on the real weight of the final results, as measured in our test kitchen.

For more on weight-to-volume conversions for common foods, see the reference tables beginning on page XXXVI.

Temperatures in the book are given in both Celsius and Fahrenheit. In general, where precise temperature is less critical, we do some rounding. It doesn't help much to know that 57 degrees Celsius equals 134.6 degrees Fahrenheit; 135 °F will work fine. Kitchen thermometers typically don't operate well at more than one to two full degrees of accuracy anyway (see page 1·269), and the controls of ovens and deep-fryers often jump by five-degree intervals.

But one of the central themes of Modernist cooking is that exact temperature control is called for under certain circumstances. Water baths used for sous vide cooking (see page 2·236) are a means of precisely controlling temperature. Accuracy is particularly important in the lower range of cooking temperatures. Typically, the higher the temperatures, the less critical it is that they be precise. But when you're cooking salmon *mi-cuit* (literally "partially cooked"), the color of the flesh shouldn't change from the raw state, which requires careful temperature management. You need to cook the fish within a very narrow range, to no more than 40 °C / 104 °F; above that, it becomes difficult to control the results. Many gelling agents are effective up to 85 °C / 185 °F, but if they are heated to higher than that temperature, the gel can fail.

Another issue to consider is that some of the newer ingredients, like hydrocolloids, come in a range of grades, brands, and proprietary blends. We list the specific brands we use as a point of reference and to provide some guidance about the properties that other brands may have. Don't let

these slight variations intimidate you; once you get the hang of it, these details become second nature.

Sometimes a recipe will go awry for any number of reasons. Perhaps you're using a finicky hydrocolloid like gellan, which might gel prematurely if your tap water has a particularly high mineral content. Or perhaps your sous vide bags are leaking. We have tried to offer plenty of troubleshooting notes and examples of various scenarios to help you diagnose the most common problems, but we surely haven't caught them all. Unfortunately, there are many more ways to do something wrong than to do it right. When all else fails, try to treat these outcomes as a learning opportunity.

Baker's Percentage

You'll often want to scale a recipe up or down. You can do this by multiplying the ingredient quantities by a given factor or by doing some division to figure out the ratios of the ingredients.

The best system that we have found for making a recipe easy to scale is called baker's percentage, a method of measurement that is widely used in pastry and baking books. In a recipe that uses baker's percentage, one reference ingredient—usually the ingredient that most affects the yield or the cost of the recipe—is set to 100%. The quantity of each other ingredient is then cited as a percentage of the reference ingredient's weight.

Michael Ruhlman's cookbook *Ratio: The Simple Codes Behind the Craft of Everyday Cooking* is dedicated to the idea of using ratios to express quantities in recipes.

For example, our recipe for Sous Vide Instant Hollandaise (see page 4·228) sets egg yolks as the reference ingredient at 100% and calls for 75 grams of yolks. It calls for vinegar at a scaling of 47%, meaning 47% of the weight of the egg yolks—not 47% of the yield or 47% of the sum of all ingredients, just 47% of the weight of however much the yolks weigh.

So if you're using 75 grams of egg yolks to make the recipe, you need 35 grams of vinegar, because 75 grams times 47% equals 35. But say you only have 65 grams of egg yolks. How much vinegar should you use? This is where the scaling percentage really simplifies things. Just multiply the same 47% for vinegar times the actual weight of egg yolks available—65 grams—to get the answer: 30.5 grams of vinegar.

Keep in mind that the percentages of the minor ingredients will not add up to 100% because scaling percentages give the weight as a proportion of the weight of the reference ingredient, not of the total weight of all ingredients in the recipe.

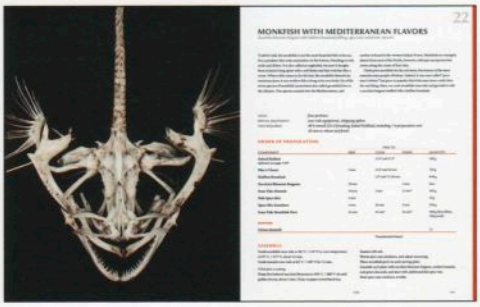
One challenge in using baker's percentages is that they can be difficult to use if you want to omit or add an ingredient, or if you substitute several ingredients of different quantities. This issue comes up most frequently in recipes that involve small quantities of potent thickeners or gelling agents, but also for more common ingredients such as salt. In the hollandaise recipe, for example, if you decided to use a more flavorful wine and stock, you may choose to reduce it a bit less than the recipe calls for to achieve the balance of flavors you want. But how should you then adjust the quantity of egg yolks to preserve the texture of the sauce?

We provide a special scaling percentage in many cases to help with such situations. A note at the bottom of the recipe explains how the special percentage is calculated. Often it is a proportion of the weight of all ingredients in the recipe or of all *other* ingredients (omitting the weight of the ingredient that has the special percentage listed). In the example above, we added the weights of the wine–shallot–vinegar reduction, the stock or water, and the butter, which came to about 268 grams when we made the recipe. The weight of the eggs, at 75 grams, is 28% of 268 grams, so we include the 28% as a special scaling percentage.

So, if in your adjustments to the recipe, you find that you end up with 300 grams of reduction, stock, and butter instead of the 268 grams we got, you can easily work out how much egg yolk to use by simply multiplying 300 grams by 28%: 84 grams of yolk should produce a texture very close to the original version.

The special scaling sometimes becomes crucial when using recipes that include hydrocolloids that are quite powerful in small quantities, so must be added with great precision. Our recipe for a gelled Long Island Iced Tea on page 4·141, for example, suggests using 5.6% as much gelatin as you use of cola, thus 6.75 grams if using 120 grams of cola. But that ratio would not work well if you were to omit the tequila. In that case, you should instead use the special scaling listed for gelatin, which is 1.6% of the total weight of all the other ingredients, or 6.25 grams.

Similarly, if you wanted to add, say, 60 grams of whiskey to the recipe, the special scaling percentage would let you easily work out the right amount



Plated-dish recipes are the most involved recipes in the book because they bring together multiple components, including a main dish, side dishes, sauces, and garnishes. A brief introduction (1) provides historical or culinary context for the dish. It is followed by a "dashboard" view (2) that gives an overview of the recipe components, the time you'll need to budget to make each part, any special equipment that is required (or that is optional but handy), and the assembly steps involved in bringing everything to completion at the same time.

Yield for the recipe as a whole is given as a number of portions. Several times are listed in the TIME REQUIRED: section. (3) The "overall" time indicates clock time from the start of preparation to serving time. Because many recipes require long periods of cooking, curing, fermenting, etc. that do not require a cook's attention, we also indicate the amount of hands-on kitchen time needed for preparation. Finally, we give the reheating and finishing time to let you know how far in advance of serving you should begin final assembly.

The component dishes in the recipe are then listed in a suggested order of preparation, (4) with those parts that are easily (or necessarily) made in advance given first. Although the recipes for most components follow the dashboard page, some may be found instead in other parts of the book, in which case a page reference is given. (6) Components that are optional are clearly noted as such. (5)

For each component, we list the quantity needed and three useful times: the hands-on prep time, the time needed for any finishing steps during assembly, and the cooking time. Cooking steps that do not require active attention are set in italics; (8) in cases where a dish involves both attended and unattended cooking steps, times are given separately for each. (7)

Instructions for finishing and final assembly of the plated dish appear after the table of components. (9) The most difficult part of making a complex meal is completing all the last-minute cooking, dressing, and garnishing in the few minutes before it is served. To help you pull off this feat, all of these final steps are presented together in this spot and arranged clearly in a practical order.

The remaining pages of the plated-dish recipe are devoted to recipes for the components, (10) each of which is presented using the same approach we take for example recipes (see page 1·96). Where space permits, we have included photographs showing some of the steps involved. Notes in the margin (11) provide tips and ideas for substitutions.

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MONKFISH WITH MEDITERRANEAN FLAVORS

Zucchini blossom beignet with halibut brandade filling, spice mix emulsion, mussels

(1)

Truth be told, the monkfish is not the most beautiful fish in the sea. It is a predator that waits motionless on the bottom, blending in with rocks and debris. It is also called an anglerfish, because it dangles from its head a long spine with a soft fleshy end that twitches like a worm. When a fish comes in for the bait, the monkfish distends its enormous jaws; it can swallow fish as long as its own body. Six of the seven species of monkfish (sometimes also called goosefish) live in the Atlantic. One species extends into the Mediterranean, and another is found in the western Indian Ocean. Monkfish are strangely absent from most of the Pacific, however, with just one species that swims along the coasts of East Asia.

Chefs prize monkfish for the tail meat; the texture of the meat reminds some people of lobster. Indeed, it was once called "poor man's lobster" but grew so popular that it became more costly than the real thing. Here, we cook monkfish sous vide and garnish it with a zucchini beignet stuffed with a halibut brandade.

(2)

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, whipping siphon*
TIME REQUIRED: (3) *49 h overall (15 d if making Salted Halibut), including 1 h preparation and 30 min to reheat and finish*

(4) ORDER OF PREPARATION:

COMPONENT	PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
(5) **Salted Halibut** optional, see page 3-187 (6)		*12 h* and 15 d**		160 g
Pâte à Choux	5 min	(7) *12 h** and 10 min		750 g
Halibut Brandade		2 *d** and 1 h 20 min		640 g
Zucchini Blossom Beignets	10 min		5 min	four
Sous Vide Mussels	10 min	3 min	*15 min**	450 g
Fish Spice Mix	5 min			10 g
Spice Mix Emulsion	5 min	20 min	2 min	250 g
Sous Vide Monkfish Pavé	25 min	(8) *45 min**	*25 min**	400 g (four fillets, 100 g each)
GARNISH				
Green almonds				12

**(unattended times)*

ASSEMBLY: (9)

Cook monkfish sous vide at **48** °C / **119** °F to core temperature of **47** °C / **117** °F, about 25 min.
Cook mussels sous vide at **65** °C / **149** °F for 12 min.

While fish is cooking:
Deep-fry battered zucchini blossoms in **195** °C / **380** °F oil until golden brown, about 3 min. Drain on paper towel-lined tray.

Season with salt.
Warm spice mix emulsion, and adjust seasoning.
Place monkfish pavé on each serving plate.
Garnish each plate with zucchini blossom beignet, cooked mussels, and green almonds, and dust with additional fish spice mix.
Pour spice mix emulsion at table.

(10) HALIBUT BRANDADE

Yields 800 g

(11) The quantity of the whole milk will depend on the size of the fish as well as the shape and size of the container.

Good quality, store-bought salt cod can be substituted for the halibut.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk	as needed		① Soak halibut in milk for 12 h.
Salted halibut optional, see page 3-187	160 g	100%	② Drain fish, and discard milk.
Garlic, sliced and blanched twice	25 g	16%	③ Repeat steps 1 and 2 three times, for total soaking time of 48 h. Reserve 20 g of liquid from final soaking step.
			④ Vacuum seal reserved soaking liquid, halibut, and garlic together.
			⑤ Cook sous vide at 58 °C / 135 °F to a core temperature of 57 °C / 133 °F, about 20 min. Hold at this core temperature for another 15 min.
			⑥ Pulse in food processor until finely shredded.
Water	1 kg	625%	⑦ Vacuum seal potato slices in a thin even layer.
Yukon Gold or other waxy potatoes, thinly sliced	250 g	156%	⑧ Cook sous vide at 90 °C / 194 °F for 45 min.
			⑨ Drain potatoes, and pass through ricer.
Extra-virgin olive oil	90 g	56%	⑩ Mix into potatoes.
			⑪ Pass through a fine sieve.
			⑫ Fold sieved potatoes into halibut-garlic mixture.
			⑬ Refrigerate.

of gelatin to use, which is 1.6% of the new total (450 g) of other ingredients: 7.2 grams of gelatin. Without the special percentage, you would be tempted to use just 6.75 grams of gelatin, and the result may not set the way the original recipe does.

Recipes for Plated Dishes

The book features three fundamental classes of recipes: example, parametric, and plated dish. Each serves a different purpose in illustrating how particular ingredients or techniques can be applied in the kitchen. Example recipes and parametric recipes are described on page 1·97.

Plated dishes come in a wide variety of styles. We have full-on Modernist dishes that would not be out of place at leading Modernist restaurants. But we also have dishes that are far more informal, like barbecue from the American South, a pork belly picnic, and even the perfect omelet. For us, a plated recipe doesn't have to be fancy, as long as it's made with the quality and care of more elaborate preparations. Our hamburger is the best one we know how to make, and we believe that you should put every bit as much effort into making a great hamburger as you would if you were making dishes with loftier ambitions.

Some Modernist dishes are lavishly complex à la Heston Blumenthal, while others are boldly minimalist in the style of Ferran Adrià. Other Modernist chefs, including Grant Achatz, David Kinch, and Joan Roca, have their own styles somewhere in between. Our plated-dish recipes exemplify all of those styles.

For more on Grant Achatz, see page 1·68. For more on David Kinch, Joan Roca, and Thierry Rautureau, see page 1·67, page 1·58, and page 1·x, respectively.

The other plated dishes are no less stylistically diverse. It might come as a surprise that we devote so much attention to American barbecue, but we're big fans of this cuisine. Indeed, we find that barbecue exhibits enormous depth and complexity that is rarely understood outside its home region (and too frequently ignored outside of the United States). Initially we set out to create one barbecue recipe, but the idea soon grew to include sauces and barbecue styles from every region of the country (see page 66). Perhaps we went overboard, but our goal is to serve up a broad range of experiences.

After our test kitchen had made its way through the barbecue recipes, a member of the kitchen team, Anjana Shanker, suggested developing Modernist versions of some Indian curries. She reasoned that Indian curry dishes, like American barbecue, come in a vast variety of regional styles. The recipes she came up with were so good that we had to put them in the book. They illustrate how even culinary traditions stretching back hundreds (or in some cases, thousands) of years can be revisited with a Modernist palate and sensibility—to delicious and thought-provoking effect.

Credit Where Credit is Due

Because we selected recipes to illustrate important concepts in the development of Modernist cuisine, it is only natural that many originated as contributions from the chefs who first used the given technique in a fine-dining context. For example, Ferran Adrià was the first to introduce spherification to a restaurant setting, and we have included example recipes that cover two of his iconic creations: imitation caviar and faux olives.

It is not always the case that the example recipe we have is from the chef who did it first, however; we chose some recipes simply because they seemed to best exemplify the topics explained in the book. Although we have gone to some effort to document history in this chapter, the rest of the book is first and foremost about teaching technique.

Every recipe included here was tested in our kitchen laboratory after a tremendous amount of our own recipe development work. But we've also had a great deal of help from leading chefs around the world, and we believe it is important to give credit where it is due. Some of the people who inspired recipes in this book don't know or necessarily endorse the fact that we've used their recipe as a launching point for one of our own. That is particularly true of historical recipes, from chefs who are no longer with us but who, we hope, would be pleased to play a role in this collection. The older, more traditional recipes are also among those we've most modified to recast them in a Modernist style with newer techniques or ingredients.

Thus, if we cite a recipe as being "inspired by" a particular chef, it means we have modified the recipe in important ways. We may have applied Modernist ingredients or techniques to a basic recipe idea that was first developed in a traditional context.

For example, we include a recipe for spot prawns in a foie gras nage, inspired by a dish from

Thierry Rautureau, a French chef in Seattle with whom I apprenticed for some time. His version is a fantastic dish, but it is entirely traditional in its technique and ingredients. Our version uses a Modernist emulsifier, propylene glycol alginate, to keep the nage from separating, and we cook the prawns sous vide or with low-temperature steam. On one hand, ours is very different from Rautureau's recipe, but on the other, it is completely inspired by a truly memorable meal at which he served this dish more than 10 years ago.

Another reason we might note that a recipe is "inspired by" a particular chef is that we are using only a single component from a dish that that chef created. The goal in this case isn't to showcase the chef's cuisine and the original dish in its full form but simply to use part of the recipe as a teaching tool, somewhat out of context. We're incredibly grateful to all these chefs who—whether they know it or not—have inspired the development of recipes in this book.

In other cases, we started by creating a dish or an element of a dish, then sought out a traditional recipe in which to embed our new creation. This process led to some of the "inspired by" recipes in the collection—they have at least one element that was inspired by the chef we name, but the rest of the components may be quite different.

We say that a recipe is "adapted from" a particular chef when it is one step closer to how that chef might actually make it. In most such cases, we have still made some adjustments to techniques or ingredients, and we may have rearranged procedures a bit to explain things more clearly.

Ultimately, we take full responsibility for all recipes in this book and how they turn out in your kitchen. We've tested them all extensively, and although we'd like to feel they are foolproof, it's likely that some steps allow a bit more latitude than we anticipated, leaving a little room for error.

After a lot of discussion, we decided to credit the recipes (both "inspired by" and "adapted from") to individual chefs rather than to restaurants. There are several reasons for this. First, many chefs have more than one restaurant, and some have television shows for which they have developed recipes: Heston Blumenthal is one example, but there are others.

Similar issues come up with cookbook writers; in those cases, it seems clear that credit should go to the author, not to the book. The same holds for web sites and other venues for disseminating recipes. So we decided as a rule to assign credit to individuals.

But we recognize that the development of recipes is often a team effort. So when we credit chefs like Blumenthal or Adrià, that credit should be interpreted as going to the culinary teams they lead. Many of the innovations likely have been developed, honed, or improved by many people on the team, not just the chef who leads the group.

The word *chef,* of course, is French for "chief, manager, or leader." The very best chefs are exactly that: leaders who inspire and manage a team. It is customary to attribute any team's efforts to the leader, particularly in the kitchen, but we all know that the leaders would be a lot less productive without their teams' support. This book, by the way, is no different; without an incredible team of talented people, it would have been impossible to create it.

As for the photographs that accompany our recipes, most are images that we took ourselves, though in a few cases we do include an image that was supplied by the chef who created the dish. We recognize that the way we've assembled and presented each dish may or may not be done exactly as it would have at the chef's restaurant; but the intent is to exemplify the chef's inspiration. We have no expectation that this book duplicates chefs' recipes and culinary styles as they would express them in their own cookbooks. After all, that is why they write them. Our book is instead a repository of culinary technique, with many ideas that most cookbooks don't have the space or resources to provide.

The remaining recipes are those that we developed from scratch on our own. For example, we wanted to figure out how to make an instant soufflé, but we really had no starting point to work from. We just began working through a range of ideas and options without a clear path, eventually creating a recipe that calls for expelling a pre-made soufflé mixture from a whipping siphon into a ramekin, then putting it in the oven. It's a method we're quite pleased with. For all we know, someone else out there had already done the same thing—we just weren't able to find it. If we've inadvertently missed someone who feels she or he developed a dish that we have not given that person credit for, we apologize.

Physical safety is always an important consideration in the kitchen, and it can be especially so with certain aspects of Modernist cooking. Some items in the Modernist toolbox, such as liquid nitrogen, are unusual, and you need to learn unique safety precautions in order to handle them. But we'd also point out that many elements of traditional cooking can require special precautions as well. Oil for deep-frying that's heated to 205 °C / 400 °F is a pretty dangerous liquid, too.

Food safety is important as well—so much so that we devote chapters 2 and 3 to the subject. In addition to these specialized sections, we have provided safety-related notes in many of the recipes. These notes are not meant to be exhaustive—cooks should exercise the appropriate care and caution in every dish they make—but they may call attention to cases where safety issues are not necessarily obvious.

PLATED-DISH RECIPES

TENDER CUTS

BEEF RIB STEAK

Shiitake marmalade, creamed watercress, aged beef jus

Many people prefer their beef rare to medium rare; so do we. Yet when making consommé or jus, the same people often cook beef into submission at fairly high temperatures—partly because they think that is necessary to extract flavor and get the right body, and partly out of deference to a tradition of cooking stocks for hours. Taking the opposite tack, we developed a method to make a jus sous vide to capture the essence of rare beef.

We serve the jus with a thick rib steak topped with rich suet mousseline and a comforting cup of silky smooth potatoes. Potato puree is delicious, but because nearly half its weight is butter, it can lose potato flavor. We cook the potatoes with potato flakes in raw potato juice to help regain that flavor. This might seem like cheating, but try toasting the flakes in clarified butter before adding them to the puree. The intense roasted-potato flavor you get will make you a convert.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, juicer, gas blowtorch, whipping siphon, Pacojet*
OPTIONAL EQUIPMENT:	*centrifuge*
TIME REQUIRED:	*8 h overall, including 5½ h preparation and 1 h to cook and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Tomato Water see page 2·366	10 min	*1 h**		40 g
Brown Beef Jus see page 2·344	45 min	4 h		100 g
Creamed Watercress see page 2·426	30 min	*2 h**	3 min	120 g
White Beef Stock see page 2·296	15 min	1½ h		350 g
White Onion Puree see page 2·424	10 min	30 min		50 g
Aged Rare Beef Jus	15 min	*4 h**	10 min	200 g
Shiitake Marmalade	20 min	20 min and *3 h**	30 s	30 g
Sous Vide Beef Rib Steak	5 min		55 min	800 g
Potato Puree	15 min and *1 h**	35 min		700 g
Suet Mousseline	20 min	20 min	10 min	100 g
Salt Gel optional	2 min	5 min		20 g
Toasted Garlic Chips	5 min	20 min		12
GARNISH				
Rosemary blossoms				16
Green peppercorns (fresh)				12
Wild watercress leaves				12

**(unattended times)*

ASSEMBLY:

Heat beef suet mousseline in **62** °C / **144** °F water bath.

Reheat steak in water bath to cooking temperature used. For estimated reheating times, which vary with thickness, see next page and 2·276.

Remove steak from bag, and sear all surfaces with blowtorch until golden. Let rest for 10 min.

While steak is resting:

Reheat rare beef jus in **52** °C / **125** °F water bath for 10 min.

Reheat potato puree in **75** °C / **167** °F water bath for 10 min.

Pacotize frozen watercress cream.

For more on the step-by-step procedure for making creamed watercress, see page 2·426.

Transfer warm potato puree to serving bowl, fold in grain mustard if desired, and season with salt.

Warm shiitake marmalade over medium heat, and season as needed.

Cut steak from bone, and slice 5 mm / 3⁄16 in thick.

Garnish steak with garlic chips, rosemary blossoms, peppercorns, and watercress leaves.

Serve mousseline, creamed watercress, shiitake marmalade, potato puree, and rare beef jus on side in individual serving dishes.

Grate salt gel over steak at table.

Searing the steak is easier with a high-heat torch, such as a MAPP-gas or oxyacetylene torch. Small butane torches have a tendency to burn "dirty" and taint the food with the taste of fuel. Butane torches also don't have as hot a flame.

AGED RARE BEEF JUS

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Aged beef chuck steak, cut into 2.5 cm / 1 in cubes	700 g	700%	① Vacuum seal.
			② Cook sous vide in 53 °C / 127 °F bath for 4 h.
Bromelain capsules, ground to fine powder (optional, NOW brand)	1.4 g	1.4%	③ Press against fine sieve to get juice, discarding meat.
			④ Centrifuge juice at 27,500*g* for 30 min to yield about 100 g of aged beef jus, and reserve.
Water, cold	100 g	100%	⑤ Disperse gums in water.
Xanthan gum	0.3 g	0.3% (*0.15%*)*	
Guar gum	0.1 g	0.1% (*0.05%*)*	
Aged beef jus, from above	100 g	100%	⑥ Blend gum mixture into aged beef jus until completely fluid.
Monosodium glutamate (MSG)	2 g	0.4%	⑦ Season jus.
			⑧ Cool, and vacuum seal.
Salt	to taste		⑨ Refrigerate.

(% of total weight of water and aged beef jus*)*

Bromelain is an enzyme extracted from pineapples that is sometimes used for tenderizing meat. Adding it here greatly increases the yield of jus.

MSG doesn't deserve its bad name. It is in everything from shiitake mushrooms and tomatoes to mother's milk. See page 1·213 for more information on this ubiquitous naturally occurring compound.

Beef rib is not one muscle but three: the loin (the eye), the deckle (cap), and the relatively unknown spinalus dorsi. Many cooks know that the deckle is extra juicy and tender. Unfortunately, because it sits on the outside of the roast, the deckle is often overcooked. It is best to remove it and cook it separately, as you would a tender fillet.

The spinalus dorsi—the small, dark red, crescent-shaped muscle that lies next to the chine bone—is so intimately blended into the loin muscle that it is sometimes difficult to locate. In light-colored meats, such as pork, its darker color makes it easy to spot, and a cut that includes it is labeled the "best end." But this especially tender, juicy, and flavorful muscle is difficult to spot in red meats, including beef.

The muscle is so good to eat, however, that you should make sure your butcher cuts your rib roast to include it. Ask that your steaks be cut from between ribs 5 and 6, and 9 and 10. For more details, see Cutting, page 3·44.

SHIITAKE MARMALADE

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shallots, finely minced	70 g	70%	① Sauté over low heat until tender, about 20 min.
Shiitake mushrooms, brunoise	26 g	26%	
Clarified unsalted butter	10 g	10%	
Garlic, brunoise	10 g	10%	
Rendered beef marrow	10 g	10%	
Tomato water see page 2·366	40 g	40%	② Add to shallot mixture, and reduce to 50 g to make marmalade base.
Sherry vinegar	20 g	20%	③ Reserve.
Brown beef jus see page 2·344	100 g	100%	④ Disperse gelatin into beef jus. ⑤ Heat to fully dissolve gelatin.
160 Bloom gelatin	3 g	3%	
Xanthan gum	0.3 g	0.3%	⑥ Blend into stock reduction. ⑦ Fold in other ingredients.
Black pepper, coarsely ground	0.25 g	0.25%	⑧ Season marmalade. ⑨ Cool, vacuum seal, and refrigerate.
Salt	to taste		

SOUS VIDE BEEF RIB STEAK

Yields 800 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Prime aged rib steak, on bone see page 3·39	1 kg	100%	① Vacuum seal rib steak with suet. ② Cook sous vide to core temperature of 53 °C / 127 °F for rare, 55 °C / 131 °F for medium rare, or 57 °C / 135 °F for pink, by using water bath set 1 °C / 2 °F higher than the target core temperature. For estimated cooking times, which vary with steak thickness, see page 2·276.
Rendered suet	75 g	7.5%	③ Cool quickly in ice-water bath, and refrigerate.

POTATO PUREE

Yields 700 g

Instead of using a centrifuge, you can let potato juice sit overnight to settle, then carefully decant the juice.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yukon Gold potatoes, peeled	375 g	250%	① Juice potatoes in a vegetable juicer. ② Centrifuge juice at 27,500*g* for 1 h. ③ Decant juice through fine sieve. ④ Vacuum seal. ⑤ Cook sous vide in 90 °C / 194 °F bath for 20 min. ⑥ Pass through fine sieve, and reserve 150 g.
Potato juice, from above	150 g	100%	⑦ Warm butter over low heat. ⑧ Add potato flakes and toast, stirring constantly, until golden brown, about 7 min. ⑨ Add potato juice, bring to a boil, and remove from heat.
Clarified unsalted butter	37.5 g	25%	
Instant potato flakes	37.5 g	25%	
Unsalted butter, melted	200 g	133%	⑩ Fold butter in gently until melted. ⑪ Reserve 425 g.
Yukon Gold potatoes	325 g	216%	⑫ Bake in 200 °C / 400 °F oven for 1 h. ⑬ Cut potatoes in half, and scoop out hot flesh. ⑭ Pass through fine-mesh drum sieve. ⑮ Reserve 280 g of sieved potatoes.
Potato juice-butter mixture, from above	425 g	283%	⑯ Whisk Ultra-Sperse into potato juice–butter mixture over low heat until warm. ⑰ Whisk in sieved, baked potatoes slowly. ⑱ Cool in ice-water bath. ⑲ Vacuum seal. ⑳ Refrigerate.
Sieved potatoes, from above	280 g	186%	
Ultra-Sperse A (National Starch brand)	3.5 g	2.3%	
Grain mustard, optional	30 g	20%	㉑ Reserve individually.
Salt	to taste		

SUET MOUSSELINE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White beef stock see page 2-296	350 g	100%	① Combine, and reduce to 100 g. ② Strain. ③ Cool. ④ Measure 75 g.
White wine (dry)	250 g	71%	
Shallot, finely minced	55 g	16%	
White wine vinegar	35 g	10%	
Black pepper	0.7 g	0.2%	
Wine reduction, from above	75 g	21%	⑤ Disperse gellan in cream. ⑥ Blend thickened cream with wine reduction. ⑦ Vacuum seal. ⑧ Hydrate in 85 °C / 185 °F bath for 5 min. ⑨ Cool until set. Puree to fluid gel.
Heavy cream, cold	50 g	14.5%	
Low-acyl gellan (Kelcogel F)	1.2 g	0.3% (*0.3%*)*	
Egg yolks, cooked sous vide in 62 °C / 144 °F bath for 35 min	90 g	26%	⑩ Blend with fluid gel.
Beef suet, vacuum sealed	200 g	57%	⑪ Warm fluid gel mixture and suet separately in 62 °C / 144 °F bath. ⑫ Blend warm suet into fluid gel until fully emulsified. ⑬ Season mixture generously. ⑭ Pour into 1 l siphon, and charge with two nitrous oxide cartridges. ⑮ Hold in 62 °C / 144 °F bath until use.
Lemon juice	to taste		
Salt	to taste		

(% of total weight of heavy cream, wine reduction, egg yolks, and beef suet*)

SALT GEL

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Distilled water, cold	400 g	100%	① Disperse salt and agar in water.
Salt	40 g	10%	② Bring to boil, and hold for 2 min while stirring to hydrate.
Agar	12 g	3%	③ Cast in desired mold.
			④ Refrigerate.

The salt gel can be grated and used to season any dish in which you want salt crystals that will not dissolve.

TOASTED GARLIC CHIPS

Yields 24 pieces

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Garlic cloves	50 g	100%	① Slice 1 mm / 1/16 in thick.
Milk, cold	as needed		② Cover garlic slices with milk, heat to 70 °C / 158 °F, and drain.
			③ Repeat two more times.
Frying oil	as needed		④ Deep-fry garlic slices in 160 °C / 320 °F oil until golden and crisp, about 5 min.
Salt	to taste		⑤ Season.
			⑥ Store in cool, dry place.

MUSHROOM SWISS BURGER

Emmental cheese single, mushroom ketchup, shallot rings

The hamburger is an icon of American cuisine. But this simple sandwich has spawned an impressive range of guises. At Louis' Lunch in New Haven, Connecticut, the hamburger is interpreted with puritanical asceticism: a broiled beef patty between toast, no condiments.

At the other extreme, Daniel Boulud's decadent version is made with a complex blend of meats—and stuffed with foie gras. Many inhabitants of America's heartland attach a deep cultural importance to the local White Castle Original Slider, while folks on the West Coast are more likely to sing the praises of an In-N-Out burger, Animal Style.

All of these burgers are fantastic in their own way. But to our taste, it's hard to beat a juicy, tender mushroom burger with Swiss cheese. We therefore humbly present a no-holds-barred Modernist cheeseburger—one of the tastiest products to emerge from our culinary laboratory.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous-vide equipment, meat grinder with 4 mm / 3⁄16 in plate*
OPTIONAL EQUIPMENT:	*food processor*
TIME REQUIRED:	*30 h overall, including 2½ h preparation time and 20 min to assemble*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Tomato Confit see page 62	30 min	*5 h**		40 g
Brown Beef Stock see page 2·296	30 min	*2 h**		90 g
Short-Rib Patty see page 3·234	20 min	*2 h**	5–8 min	four patties, about 120 g each
Hamburger Bun	1 h	*30 h**	2 min	four buns, about 90 g each
Mushroom Broth	5 min	1 h		14 g
Freeze-Dried Shiitake Mushroom optional, see pages 3·372 and 2·450	5 min	*48 h**		30 g
Mushroom Ketchup	20 min	45 min		10 g
Restructured Emmental Slice see page 4·222	10 min	*2 h** and 15 min	1½ min	four slices, 15 g each
Ultrasonic Fries optional, see page 3·325	10 min	*1½ h**	3 min	350 g
Strawberry Milk Shake optional, see page 2·473	5 min	*1 h**	2 min	400 g
Onion Rings optional, see page 3·342	5 min	1 h and *4 h**	2 min	200 g
Hamburger Glaze	2 min	30 min	1 min	40 g
Sautéed Maitake Mushroom	2 min	5 min	2 min	14 g
Smoked Lettuce	10 min			325 g
Compressed Tomato	5 min			80 g

**(unattended times)*

ASSEMBLY:

Preheat griddle to **230** °C / **450** °F, or use grill.
Preheat frying oil to **200** °C / **390** °F for onion rings or fries.
Cook patties on griddle or grill until done.

While patties are cooking:
Brush cut sides of hamburger buns with rendered beef suet.
Toast buns on griddle.
Sauté Maitake mushrooms in suet until tender and golden, about 3 min on each side.
Deep-fry fries (if using) until golden and crisp, about 3 min.
Drain fries on paper towels, and keep warm.
Dredge frozen onion rings in tapioca starch; shake off excess.
Dip rings in egg.
Roll rings in onion cracker breading until evenly coated, and transfer to silicone mat.
Deep-fry onion rings for 2 min, taking care not to puncture or crack breading.
Drain fried onion rings on paper towel.
Warm hamburger glaze.
Top patties with cheese 1½ min before they finish cooking.

While patties are resting:
Brush bottoms of hamburger buns with mushroom ketchup. Brush tops of buns with hamburger glaze.
Season tomato slices. If serving milk shake, place ground dry ice in glasses and pour milk shake base evenly among them.
Top with patties, lettuce, tomato, mushrooms, and bun.
Serve onion rings and bubbling strawberry milk shake on the side.

For more on food safety considerations when cooking ground meats, see page 1·174.

HAMBURGER BUNS

Yields 12 buns

For a tender bun, use White Lily bread flour, which is made from soft wheat and milled to produce a minimum of damaged starch. Aficionados of Southern biscuits swear by this brand, but other soft wheat pastry flours may be used instead. If substituting all-purpose flour, use a little more water when making the dough. The buns will be chewy and tougher but still presentable.

If using instant yeast, use one-third of the amount indicated in the recipe.

L-cysteine is an amino acid that causes gluten to relax. It gives this dough its characteristic flowing texture.

For more on fat-rendering strategies, see page 3·145.

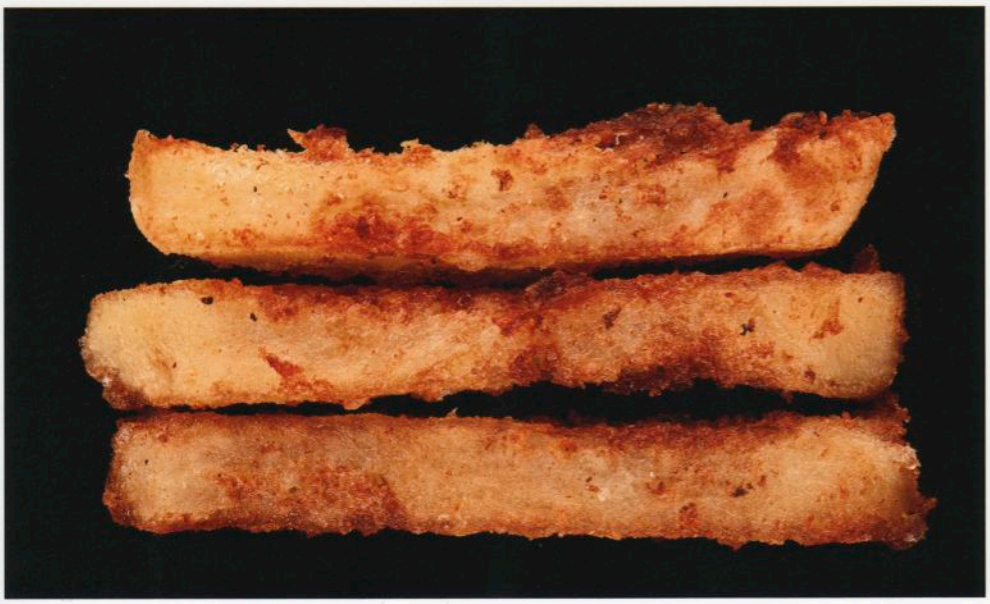
INGREDIENT	QUANTITY	SCALING	PROCEDURE
For the sponge:			
White Lily bread flour	310 g	65%	① Mix together on low speed, using a paddle attachment, for 8 min.
Yeast (fresh)	2 g	0.4%	
Water (**5** °C / **41** °F)	189 g	40%	② Cover tightly, and refrigerate for 24–48 h.
For the dough:			
White Lily bread flour	480 g	100%	③ Mix together flour and water on low speed for 4 min.
Water (**30** °C / **86** °F)	270 g	56%	④ Stop mixer, and cover bowl with hot, wet cloth for 45 min.
Yeast (fresh)	9.5 g	2%	⑤ Mix into flour mixture.
Sponge, from above	120 g	25%	⑥ Add to flour mixture, and mix on medium speed for 4 min.
Sugar	72 g	15%	
Egg yolks	50 g	10%	⑦ Ferment dough, covered, at room temperature for 1 h.
Vegetable shortening	25 g	5%	⑧ Form into twelve 90 g balls.
Salt	9.5 g	2%	⑨ Arrange balls into 11 cm / 4¼ in ring mold.
Vanilla extract	0.5 g (two drops)	0.1%	⑩ Proof at 85% RH and **40** °C / **104** °F until dough has expanded to fill ring, about 1½ h. If proofing cabinet is unavailable, cover with oiled plastic wrap and keep in warm place until proofed, at least 1½ h.
Lemon essential oil	0.2 g (one drop)	0.04%	
L-cysteine	0.04 g	0.01%	⑪ Press gently on proofed buns to flatten.
Whole milk	as needed		⑫ Brush bun tops lightly.
Black poppy seeds, toasted	as needed		⑬ Combine, and sprinkle on bun tops.
Black onion seeds	as needed		⑭ Bake in **260** °C / **500** °F oven for 6 min.
Black sesame seeds, toasted	as needed		
Rendered beef suet	40 g	8.5%	⑮ Measure and refrigerate for service.

MUSHROOM KETCHUP

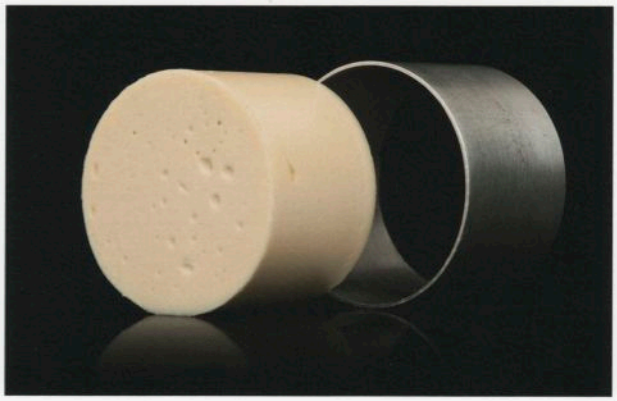
Yields 750 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yellow onions, thinly sliced	350 g	54%	① Sauté until translucent, about 7 min.
Olive oil	53 g	8%	
Garlic, thinly sliced	32 g	5%	② Add to onions, and cook for 1 min.
Ginger, thinly sliced	7 g	1%	
Crimini mushrooms, thinly sliced	650 g	100%	③ Combine with onion mixture and simmer, stirring frequently, until mushrooms are very tender and liquid has evaporated, about 35 min.
Malt vinegar	155 g	24%	
Dark ale	105 g	16%	④ Blend until smooth.
Mushroom broth, from above	70 g	11%	⑤ Pass through fine sieve.
			⑥ Adjust seasoning to taste.
Barley malt syrup	40 g	6%	⑦ Measure 800 g of ketchup.
Cane vinegar	40 g	6%	
Molasses	40 g	6%	
Fish sauce	34 g	5%	
Freeze-dried shiitake mushrooms (or dried shiitake powder)	30 g	4.5%	
Sea salt	15.5 g	2.5%	
Honey	10 g	1.5%	
Horseradish, freshly grated	7 g	1%	
Mace blades	4.2 g	0.6%	
Allspice berries	2.2 g (two berries)	0.3%	
Freeze-dried coffee powder	0.6 g	0.1%	
Ketchup, from above	800 g	123%	⑧ Blend together until smooth, and refrigerate.
Xanthan gum	1.6 g	0.25% (*0.2%*)*	

(% of weight of ketchup*)



For more on ultrasonic fries, including a step-by-step procedure, see page 3·325.



For more on restructuring cheese, including a step-by-step procedure, see page 4·222.

RESTRUCTURED EMMENTAL SLICES

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sodium citrate	10 g	6.7%	① Combine.
Salt	3.75 g	2.5%	
Iota carrageenan	4.5 g	3% (*0.95%*)*	
Kappa carrageenan	1.5 g	1% (*0.32%*)*	
Water (5 °C / 40 °F)	100 g	67%	② Combine water and ale.
Wheat ale	75 g	50%	③ Blend in carrageenan powder.
			④ Simmer for 2 min to fully hydrate.
Aged Emmental cheese, grated	150 g	100%	⑤ Add to simmering mixture, a little at a time, blending constantly with a hand blender until texture is fluid.
Comté cheese, grated	135 g	90%	⑥ Pour into greased cylindrical mold 7 cm / 2¾ in. in diameter and at least 14 cm / 5½ in deep.
			⑦ Refrigerate until set, at least 2 h.
			⑧ Unmold, and slice to desired thickness.
			⑨ Reserve between sheets of plastic wrap.

(% of total weight of all ingredients*)

MUSHROOM BROTH

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shallots, thinly sliced	37 g	25%	① Sauté until golden, about 15 min.
Olive oil	8.5 g	6%	
Water	250 g	180%	② Pressure-cook with shallots at a gauge pressure of 1.4 bar / 21 psi for 45 min.
Crimini mushrooms, thinly sliced	140 g	100%	③ Strain and cool.
			④ Reserve for mushroom ketchup.

For more on breading onions rings, including a step-by-step guide, see page 4·302.

HAMBURGER GLAZE

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brown beef stock see page 2·296	90 g	100%	① Combine.
Tomato confit, pureed see page 62	40 g	45%	② Simmer until reduced to 100 g.
			③ Refrigerate.
Rendered beef suet	1.5 g	1.7%	
Smoked salt	1.5 g	1.7%	

SAUTÉED MAITAKE MUSHROOM

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Maitake mushrooms, each cut into four even slices about 1.5 cm / 5/8 in thick	90 g	100%	① Measure and reserve individually.
Rendered beef suet see page 3·145	40 g	44%	
Salt	1.5 g	1.5%	

SMOKED LETTUCE

Yields 90 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	150 g	167%	① Mix together.
Hickory liquid smoke (Wright's brand)	0.8 g (three drops)	0.9%	
Iceberg lettuce, cut 1 cm / 3/8 in squares	90 g	100%	② Pour smoky water over lettuce. ③ Place container, uncovered, in vacuum chamber. ④ Pull vacuum until water boils, then turn off machine and allow lettuce to absorb smoky water in vacuum chamber for 20 min. ⑤ Drain lettuce, and refrigerate.

For more on smoking techniques, see page 2·132.

COMPRESSED TOMATO

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Large beefsteak tomato	300 g	100%	① Cut X in bottom, then blanch for 10–15 s. ② Shock in ice water. ③ Peel. ④ Cut four slices about 1 cm / 3/8 in thick. ⑤ Vacuum seal to compress. ⑥ Trim to match size of bun, and refrigerate.
Black pepper	to taste		⑦ Reserve individually.
Flaky salt	to taste		

For more on vegetable compression techniques, see page 2·213.


Everything in this photo is edible.

AUTUMN HARVEST PORK ROAST

Chestnut confit, prune coals, pain d'épices

A good pork roast is as sublime as it is uncommon. The flesh should be tender and juicy, the skin delicate and crispy. But how do you get superb crackling without overcooking the meat?

The answer is to cook them separately. That may sound simple, but we have added a nonobvious step: cryosear the loin using liquid nitrogen just before frying the loin and skin. The end result is a puffed, crispy skin that covers a loin cooked evenly and easily sous vide.

The possibilities for accompaniments to this fine centerpiece are countless. But we developed this dish during autumn, when the traditional flavors of Gascony—Armagnac, prunes, chestnuts, and *quatre épices*—seemed particularly appealing.

As a final modernist twist to our interpretation of a great pork roast, we give a nod to the less ornate, simple origins of the dish: a pot roast sealed in a cast-iron vessel and cooked over the coals and ash of a dying fire. One of our chefs, Grant Crilly, encased the braised prunes in a hard, savory sugar glass made from the roast's braising juices. He then exploited a bit of chemistry and a touch of physics to foam the prunes to look like the embers of a fire.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, pressure cooker, siphon*
OPTIONAL EQUIPMENT: *freeze dryer, liquid nitrogen*
TIME REQUIRED: *49 h overall, including 5¼ h preparation time and 45 min to assemble*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Cured Bacon **optional, see page 3·182**	45 min	*72 h**		250 g
Braised Bacon	5 min	*12 h**	10 min	30 pieces, about 8 g each
Charred Leek Oil **optional**	5 min	45 min		25 g
Chestnut Confit	10 min	*12 h**	10 min	200 g
Sweet-and-Sour Cipolline	10 min	*2½ h**	10 min	80 g
Salted Caramel Apple Puree	20 min	*2½ h**	10 min	160 g
Brown Pork Stock **see page 2·296**	45 min	1½ h		400 g
Banyuls Glaze	30 min	2 h	3 min	100 g
Chestnut Puffs	10 min		15 min	240 g
Chestnut Cream	20 min		15 min	120 g
Pain d'Épices Powder	10 min			145 g
Pork Loin Roast	20 min	*48 h**	1½ h	800 g
Puffed Pork Skin **see page 3·126**	1 h	*6 h**		300 g
Spiced Ash	5 min			20 g
Prune Coals **see page 4·314**	20 min			120 g

**(unattended times)*

ASSEMBLY:

Cook pork loin sous vide in **61** °C / **142** °F bath to core temperature of **60** °C / **140** °F, about 1½ h; longer for a full pork loin.

While pork loin is cooking:

Preheat oven to **200** °C / **390** °F for finishing chestnut puffs.
Heat frying oil for chestnut puffs to **185** °C / **365** °F.
Charge chestnut cream-filled siphon with two nitrous oxide cartridges, and reheat in **70** °C / **158** °F bath for 15 min.
Reheat apple puree, bacon, chestnut confit, and cipolline onions in **60** °C / **140** °F bath for about 10 min.
Cut onions in half, and sear until golden.
Bake chestnut puffs for 10 min.
Deep-fry chestnut puffs for 4 min. Transfer to paper towel–lined baking sheet, and reserve warm.
Whip methylcellulose solution with electric whisk or mixer until stiff peaks form. Transfer solution to container large enough to accommodate whole pork loin.

After pork loin is cooked:

Dip cooked pork loin in liquid nitrogen for 30 s, then in warm water for 5 s. (See page 3-126; this step is optional.)
Sift thin layer of starch over pork loin, and shake off excess.
Roll meat in whipped methylcellulose, then in minced pork skin.
Deep-fry in **185** °C / **365** °F oil until just puffed and golden, about 30 s.
Rest meat for 3 min.

While meat is resting:

Warm Banyuls glaze.
Fill each puff with chestnut cream by using an injection attachment on siphon to pierce puff.
Dust each puff with pain d'épices powder.
Slice roast between each bone, and arrange one slice per portion.
Finish with Banyuls glaze, apple puree, chestnut confit, onions, prune coals, and bacon. Dust spiced ash over dish.
Serve chestnut puffs on side.

BRAISED BACON

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Home-cured bacon (or store-bought bacon) see page 3-182	250 g	100%	① Rinse for 10 min in cold running water. ② Cut into 1 cm by 2.5 cm / ⅜ in by 1 in pieces.
Water	50 g	20%	③ Layer bacon pieces evenly in sous vide bag, add water, and vacuum seal. ④ Cook sous vide in **60** °C / **140** °F bath for 12 h. ⑤ Cool and refrigerate.

CHARRED LEEK OIL OPTIONAL

Yields 70 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Leek (whole)	15 g	100%	① Dehydrate in **120** °C / **250** °F oven until evenly golden brown, about 45 min.
Grapeseed oil	35 g	233%	② Heat oil and vinegar together to **82** °C / **180** °F.
Banyuls vinegar (or other semisweet red vinegar)	20 g	133%	
Salt	2 g	13%	③ Blend leek with hot liquid and salt for 3 min. ④ Cool to room temperature, then decant oil from surface. ⑤ Reserve for sweet-and-sour cipolline.

CHESTNUT CONFIT

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Italian chestnuts	180 g	100%	① Cut X into stem side of each chestnut, and blanch for 30 s. ② Peel off receded skin and shell carefully.
Rendered pork fat	90 g	50%	③ Vacuum seal chestnuts with fat and salt.
Salt	2 g	1%	④ Cook sous vide in **90** °C / **194** °F bath for 12 h. ⑤ Cool to room temperature, then refrigerate.

For more on fat-rendering strategies, see page 3-145.

SWEET-AND-SOUR CIPOLLINE ONION

Yields 80 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cipolline onion, peeled	100 g	100%	① Vacuum seal together.
White wine vinegar	55 g	55%	② Cook sous vide in 90 °C / 194 °F bath for 1 h 50 min.
Chestnut honey	29 g	29%	③ Cool immediately in ice-water bath, then refrigerate.
Charred leek oil, from above (or neutral oil)	25 g	25%	
Water	10 g	10%	
Salt	1.5 g	1.5%	

BANYULS GLAZE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ground pork	2.25 kg	100%	① Coat meats with oil.
Pork trotter, bone in, finely ground	500 g	22%	② Roast in 190 °C / 375 °F oven until golden brown, stirring frequently to ensure even browning.
Frying oil	225 g	10%	③ Remove browned meat from pan, reserving fat.
Sweet onions, peeled, thinly sliced	500 g	22%	④ Sweat vegetables in pressure cooker with reserved fat until tender.
Carrots peeled, thinly sliced	450 g	20%	
Water	1.2 kg	50%	⑤ Deglaze vegetables.
Brown pork stock see page 2·296	400 g	18%	
Banyuls wine (or other semisweet red wine)	350 g	16%	
Bay leaf	4.5 g	0.2%	⑥ Add with browned meat to vegetables in cooker. ⑦ Pressure-cook at a gauge pressure of 1.4 bar / 21 psi for 1½ h. ⑧ Cool and strain. ⑨ Reduce to glaze, and refrigerate.
Banyuls vinegar (or other semisweet red vinegar)	50 g	2%	⑩ Measure and reserve individually for service.
Unsalted butter	50 g	2%	
Salt	1 g	0.04%	

SALTED CARAMEL APPLE PUREE

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sugar	40 g	27%	① Cook to dark caramel, about 4 min.
Apple cider (store-bought)	80 g	52%	② Deglaze caramel. ③ Cool syrup to room temperature.
Apples (firm and tart), peeled, cored, and quartered	150g	100%	④ Vacuum seal together with syrup. ⑤ Cook sous vide in 90 °C / 194 °F bath for 2½ h. ⑥ Transfer from vacuum bag to a small pan.
Lemon juice	2.5 g	1.7%	⑦ Reduce juice, basting apple constantly, to thick syrup, about 5 min.
Clarified brown butter	2 g	1.3%	
Salt	1 g	0.7%	
Xanthan gum	0.3 g	0.2%	⑧ Puree with apples and syrup to smooth consistency. ⑨ Pass through fine sieve. ⑩ Refrigerate.

For more on making clarified and brown butter, see page 4·213.

CHESTNUT PUFFS

Yields 430 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk	160 g	160%	① Disperse gelatin over cold milk.
300 Bloom gelatin	10 g	10%	
Unsalted butter	45 g	45%	② Add to milk.
Rendered bacon fat	10 g	10%	③ Bring to a boil.
Salt	2.5 g	2.5%	
All-purpose flour	100 g	100%	④ Add to boiling liquid all at once. ⑤ Stir over medium heat until dough forms into a ball and a film develops on the inside of pot, about 2 min. ⑥ Transfer to stand mixer.
Eggs	150 g	150%	⑦ Incorporate eggs, one at a time, followed by the puree.
Chestnut puree (store-bought)	30 g	30%	⑧ Cast into mold in layer 1½ cm / ⅝ in thick. ⑨ Set for at least 3 h. ⑩ Cut into 1½ cm / ⅝ in cubes. ⑪ Refrigerate.
Frying oil	as needed		⑫ Reserve.
Pain d'épices powder, from below	as needed		

The steps shown below are from the recipe for chestnut puffs (previous page).

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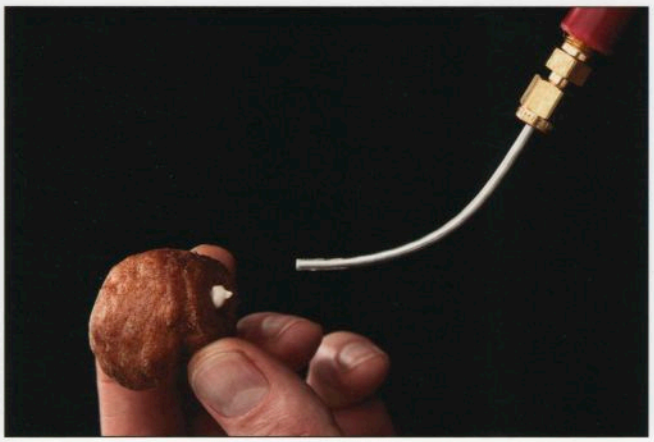
CHESTNUT CREAM

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk	150 g	150%	① Disperse iota carrageenan and gum over cold milk.
Iota carrageenan	0.6 g	0.6% *(0.2%)**	
Konjac gum (TIC Gums brand)	0.3 g	0.3% *(0.1%)**	
Chestnut puree (store-bought)	100 g	100%	② Blend with milk solution.
			③ Vacuum seal.
Heavy cream	25 g	25%	④ Place in 80 °C / 175 °F bath, and hold for 5 min to hydrate iota carrageenan.
Roasted-hazelnut oil	15 g	15%	
Sugar	15 g	15%	⑤ Pour into mold, and refrigerate until set, about 10 min.
Water	10 g	10%	⑥ Puree gel until fluid.
Salt	2 g	2%	⑦ Fill 1 l siphon with fluid gel, and refrigerate.

**(% of total weight of all ingredients)*



The chestnut puffs must be filled with chestnut cream just before serving. The best tool is this injection attachment for a whipping siphon.

After filling, dust with pain d'épices powder.

SPICED ASH

Yields 80 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pain d'épices powder, from below	45 g	100%	① Whisk together.
Carbon color powder (MSK brand)	8.5 g	19%	
Kaolin clay powder (MeadowSweet Herbs and Oils brand)	7 g	15.5%	
Roasted-hazelnut oil	12 g	27%	② Whisk oil slowly into N-Zorbit M.
N-Zorbit M (National Starch brand)	10 g	22%	③ Incorporate tinted spice blend thoroughly.

PAIN D'ÉPICES POWDER

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cinnamon stick	8 g	3.3%	① Toast spices together in 170 °C / 340 °F oven.
Star anise	3.2 g	1.3%	② Grind spices to fine powder, and reserve.
Cloves	2.5 g	1%	
Aniseeds	2 g	0.8%	
Coriander seeds	2 g	0.8%	
Spray-dried honey powder (store-bought)	240 g	100%	③ Grind together to fine powder. ④ Blend into toasted spice powder.
Salt	12 g	5%	⑤ Reserve for spiced ash and pork loin roast.
Ginger powder	3 g	1.3%	
Nutmeg, grated	3 g	1.3%	
Mace blade	1.5 g	0.6%	
Orange zest, grated	1.2 g	0.5%	

PORK LOIN ROAST

Yields 900 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Kosher salt	250 g	17%	① Mix together thoroughly.
Pain d'épices powder, from above	100 g	7%	
Rack of pork loin (first eight ribs from shoulder) with fat cap and skin	1.5 kg	100%	② Roll pork loin in spiced salt without letting salt touch ends. ③ Wrap in plastic wrap, and cure in refrigerator for 48 h. ④ Remove skin and fat, and refrigerate.
Gelatinized pork skin, dried and finely minced see page 3·126	300 g	20%	⑤ Measure and reserve individually.
Crisp Coat UC (National Starch brand)	60 g	4%	
Water	200 g	13%	⑥ Bring water to a simmer, and mix in methylcellulose with hand blender. ⑦ Hold at a simmer for 2 min while blending continuously. ⑧ Cool, and vacuum seal. ⑨ Refrigerate for 12 h to allow methylcellulose to hydrate.
Methocel E4M (Dow brand)	5 g	0.3%	
Frying oil	as needed		⑩ Reserve.

RACK OF LAMB WITH GARLIC

Seaweed tapenade, garlic nougatine, caramelized crème fraîche

Only a certain kind of sheep is hearty enough to graze on the wind-whipped salt marshes of Normandy and Brittany. Its meat, known to gourmets as *agneau de pré-salé,* has a tender, finely grained texture due to the exercise required to survive the rugged terrain, as well as an extraordinary flavor that comes from extended aging and a diet of herbs and iodine. We serve our lamb with seaweed tapenade and briny oyster beignets to evoke a sense of place.

We also accompany the lamb with garlic, a traditional partner—for good reason. Smashing a clove of garlic triggers enzymatic reactions within the clove that create sulfur-rich, pungent compounds. Cooking the garlic with meat mellows its flavor by forging new, meaty aromas from the sulfurous molecules. The rosemary, another classic addition, releases antioxidants that hinder oxidation of certain fats that can give even the finest lamb a mutton-like flavor.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, pressure cooker, whipping siphon*
TIME REQUIRED: *12 h overall, including 1 h preparation and 50 min to cook and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Lamb Garlic Jus in a Jar see page 2·348	15 min	1½ h	3 min	120 g
Pickled Garlic	15 min	*12 h**		75 g
Seaweed Tapenade	5 min	*1 h**		160 g
Garlic Confit see page 3·354	5 min			50 g
Caramelized Crème Fraîche		*2½ h**		80 g
Oyster Beignet	10 min		2 min	four
Garlic Nougatine	5 min	10 min		60 g
Rack of Lamb			*50 min**	400 g
GARNISH				
Wild garlic blossoms				12
Rosemary, brunoise				5 g

*(*unattended times*)

Rack of lamb is a real treat, but it poses a dilemma. Some people like the layer of fat on the outside—they see it as part of what makes rack of lamb wonderful—and also like the tendon left in, as shown on the previous page. Others prefer to eat rack of lamb after it has been trimmed and the internal tendon removed.

The procedure to prepare a rack of lamb this way is straightforward. First separate the fat cap and lay it flat, then remove most of the fat. Cut out the tendon, taking care to save the flap of meat between it and the skin. Fillet out any other parts you want to remove. Next, dust the surfaces with Activa RM, and reassemble the rack by using loops of butcher's twine between the bones to bind the meat together. Vacuum seal, and refrigerate overnight while the Activa sets.

ASSEMBLY:

Cook lamb sous vide in **62** °C / **144** °F bath to core temperature of **57** °C / **135** °F, about 40 min, and then let rest for 10 min.

While lamb is resting:

Heat frying oil for oysters to **200** °C / **392** °F.

Charge batter-filled siphon with two nitrous oxide cartridges. Shake vigorously.

Warm garlic and rosemary jus. Season.

Toss oysters in cornstarch and skewer them. Dispense batter into container, and dip oysters in batter to coat fully.

Deep-fry oysters briefly until golden and crispy, and just warmed through.

Remove from skewers, pat dry, and season.

Sear lamb, fat side down, until golden. Slice between ribs into individual chops. Season.

Arrange two chops on each plate. Garnish plate with spoonful of caramelized crème fraîche, quenelle of seaweed tapenade, finely chopped rosemary, one crisp oyster beignet, and three cloves of pickled garlic.

Finish each plate with warm jus and a piece of garlic nougatine.

PICKLED GARLIC

Yields 75 g

Blanching whole garlic cloves at a high temperature destroys the enzymes responsible for many of the potent-smelling sulfur compounds that are released when the cloves are cut or smashed. In this dish, the garlic is blanched long enough to produce cloves that are sweet, tart, and aromatic rather than overly pungent.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Garlic cloves	100 g	100%	① Blanch for 3 min.
			② Drain.
			③ Arrange in single layer in rigid container.
White wine vinegar	200 g	200%	④ Combine, and bring to a boil.
Water	75 g	75%	⑤ Pour over garlic cloves.
Sugar	25 g	25%	⑥ Cool.
Thyme	5 g	5%	⑦ Refrigerate for at least 12 h before serving.
Salt	4 g	4%	

Wild garlic blossom is delicious but available for only a short time in spring.

SEAWEED TAPENADE

Yields 525 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Green olives, finely minced	200 g	100%	① Drain items soaked in water. ② Reserve separately.
Dulse seaweed, soaked in water for 1 h, finely minced	100 g	50%	
Shallots, finely minced	75 g	37.5%	
Arame seaweed, soaked in water for 1 h, finely minced	50 g	25%	
Hijiki seaweed, soaked in water for 1 h, finely minced	50 g	25%	
Capers, finely minced	25 g	12.5%	
Anchovy paste	10 g	5%	③ Whisk together until smooth.
Dijon mustard	10 g	5%	④ Fold in seaweed, olives, shallots, and capers.
Lemon juice	7 g	3.5%	
Garlic, finely minced	5 g	2.5%	
Xanthan gum	0.2 g	0.1%	
Salt			⑤ Season mixture. ⑥ Refrigerate.

CARAMELIZED CRÈME FRAÎCHE

Yields 300 g

Raising the pH level (by adding baking soda) and pressure-cooking temperature greatly accelerates the Maillard reaction that produces a brown color and distinct flavor.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Crème fraîche	250 g	100%	① Combine.
Baking soda	2.5 g	1%	② Pressure-cook in Mason jars at a gauge pressure of 1.4 bar / 21 psi for 2½ h.
			③ Cool.
Garlic confit, sieved see page 3-354	50 g	20%	④ Blend into crème fraîche.
Pregelatinized starch paste (or Ultra-Sperse 3) see page 4-47	3.75 g	1.5%	
Salt	to taste		⑤ Season.
			⑥ Refrigerate.

OYSTER BEIGNET

Yields four beignets

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tapioca starch	85 g	35%	① Mix together.
All-purpose flour	60 g	25%	
Baking soda	2 g	0.85%	
Xanthan gum	0.4 g	0.17%	
Hard cider	240 g	100%	② Whisk into dry mixture to form batter.
			③ Transfer batter to siphon.
			④ Refrigerate.
Kumamoto oysters	four oysters		⑤ Refrigerate oysters.
Cornstarch	as needed		⑥ Reserve cornstarch and salt individually.
Salt	to taste		

Dulse

Sea lettuce (ulva lactuca)

Kelp

Mozoku

Hijiki

Ogo

GARLIC NOUGATINE

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Glucose syrup DE 40	100 g	100%	① Mix together.
Isomalt powder	100 g	100%	② Spread onto silicone baking mat in one layer, 1 mm / 1/16 in thick.
Unsalted butter, softened	100 g	100%	
All-purpose flour	50 g	50%	③ Cover with second silicone baking mat.
Garlic, brunoise and blanched once in boiling water	50 g	50%	④ Bake in 200 °C / 390 °F oven until golden and soft, about 5 min.
Marcona almonds, brunoise	50 g	50%	⑤ Pass rolling pin several times over top baking mat, while nougatine is still hot, to make as thin as possible.
			⑥ Warm in oven.
Salt	4.5 g	4.5%	⑦ Cut into desired dimensions while still hot.
			⑧ Store in airtight container, ideally with silica gel packet.

RACK OF LAMB

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Rack of lamb, eight ribs, frenched to loin	600 g	100%	① Wrap rosemary sprigs around bone to prevent them from being pressed into meat.
Rosemary sprigs	10 g	1.75%	
Extra-virgin olive oil	100 g	16.5%	② Vacuum seal rack with oil. Refrigerate.
Salt	to taste		③ Reserve.

For more on other recommended cooking temperatures for lamb, see page 3·96.

BLANQUETTE DE VEAU

Veal sweetbreads, constructed cream, kaolin clay, licorice

Like many classic French dishes, this one has been simplified over the years. But the signature characteristic of *blanquette de veau*—braised veal with button mushrooms and carrots in a cream sauce, served over rice pilaf—is that it is white. So, in that spirit, this *blanquette de veau* is whiter than white. Even the carrots are white. Cream sauce is often yellowed by butter, so we use a constructed cream instead. Rendered veal marrow fat is drizzled into white veal stock while homogenizing to form a nondairy veal cream. The fine fat droplets created by the homogenization scatter reflected light so well that the sauce is intensely white. The resulting "cream" is flavorful, rich, and comforting, and, because it is entirely veal, makes for a kosher blanquette.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, rotor-stator homogenizer or ultrahigh-pressure homogenizer*
TIME REQUIRED: *13 h overall, including 1 h 10 min preparation and 25 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
White Veal Stock **see page 2·296**	30 min	20 min and *2½ h**		550 g
Sous Vide Veal Sweetbreads		*12 h** and *1 h**	18 min	500 g
Rice Crisp		1 h and *3 h** and 45 s		120 g
Milk Foam	10 min	*1 h** and 5 min		500 g
Glazed White Carrot	5 min	*45 min**	15 min	300 g
Sous Vide Turnip	5 min	*20 min**	15 min	200 g
Constructed Veal Cream	20 min		15 min	200 g

**(unattended times)*

ASSEMBLY:

Deep-fry rice crisps in **190** °C / **375** °F oil until very crispy and dry, about 45 s. Drain on paper towels; season with salt.

Reheat veal sweetbreads, veal cream, carrots, and turnips in **65** °C / **149** °F bath for about 15 min.

While vegetables are heating:

Bring clay glaze for sweetbreads to a boil. Lower heat to a simmer.

Add sweetbreads to hot glaze, and baste until glaze has reduced and sweetbreads are well-coated, about 1 min. Cut sweetbreads into portions 2.5 cm / 1 in thick.

Warm infused milk to room temperature, and foam with handheld wand mixer.

Arrange sweetbread slices on plates. Garnish with milk foam, carrots, and turnips.

Finish with rice crisps, and serve veal cream separately.

SOUS VIDE VEAL SWEETBREADS

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Veal sweetbreads	500 g	100%	① Cover sweetbreads with milk. Refrigerate for 4 h.
Water	as needed		② Drain, then repeat process twice for total soaking time of 12 h.
			③ Discard liquid.
			④ Peel membrane off sweetbreads, and trim away fat and veins.
			⑤ Vacuum seal.
			⑥ Cook sous vide in 67 °C / 153 °F bath for 1 h.
			⑦ Cool and refrigerate.
White veal stock see page 2·296	300 g	60%	⑧ Combine, and reduce to 50 g.
			⑨ Bring reduction to a boil, and remove from heat.
Fino sherry	150 g	30%	
Dry licorice root	2.5 g	0.5%	⑩ Add to hot reduction, and infuse for 7 min.
Fennel seeds	0.5 g	0.1%	⑪ Strain.
Star anise	0.5 g	0.1%	
Kaolin clay	2 g	0.4%	⑫ Whisk into infused reduction to create glaze.
Salt	to taste		⑬ Season clay glaze.
			⑭ Vacuum seal.
			⑮ Refrigerate.

The term "sweetbreads" refers to either the thymus gland or the pancreas of a young animal, usually a calf or lamb. The thymus is the more elongated gland found near the throat, while the pancreas is rounder and found near the heart. The latter is more sought after because of its comparatively cleaner, more delicate flavor.

For more on alternative meats, see pages 3·96 and 3·108. Blanquette de veau is normally made with a tough cut such as veal breast, which would certainly work in this recipe—albeit with a different cooking time and temperature.

RICE CRISP

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	1 kg	500%	① Combine rice with 800 g of water. Reserve remaining 200 g of water.
Sushi rice	200 g	100%	② Cook until consistency of porridge, about 1 h.
Glutinous rice flour	120 g	60%	③ Make slurry with 200 g of water, and simmer for 2 min.
			④ Combine with cooked sushi rice, and puree until mostly smooth, but with small fragments throughout.
			⑤ Pour onto silicone mat in layer 1.5 mm / 1/16 in thick.
			⑥ Dehydrate in 50 °C / 122 °F oven until fully desiccated, about 3 h.
			⑦ Break into large fragments.
			⑧ Store in airtight container in cool, dry place.
Fine salt	as needed		⑨ Reserve individually.
Frying oil	as needed		

GLAZED WHITE CARROT

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Small white carrots, peeled	300 g	100%	① Vacuum seal together.
			② Cook sous vide in 85 °C / 185 °F bath for 45 min.
Water	50 g	17%	③ Pour cooking juices into pot, leaving carrots in bag.
Unsalted butter	45 g	15%	④ Reduce cooking juices until syrupy, about 8 min.
Fructose	6 g	2%	⑤ Return juices to bag with carrots, and cool.
Salt	3 g	1%	⑥ Vacuum seal.
			⑦ Refrigerate.

Cultivated white carrots date to the 1300s, first appearing in Germany, France, and the Netherlands. The orange carrot is thought to be a more modern development, though its provenance is in dispute. Historians say the purple carrot, cultivated in Afghanistan before the 10th century, predates both.

MILK FOAM

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Skim milk	500 g	100%	① Vacuum seal together.
Leeks, whites only, thinly sliced	75 g	15%	② Cook sous vide in 85 °C / 185 °F bath for 1 h.
			③ Strain.
Button mushrooms, gills and skin removed, thinly sliced	50 g	10%	④ Reserve hot.
Turnip, peeled and thinly sliced	35 g	7%	
Sweet onions, thinly sliced	25 g	5%	
Garlic cloves, thinly sliced	7 g	1.5%	
Thyme	0.75 g	0.15%	
Sucrose esters (Sucro, Texturas brand)	3.5 g	0.7%	⑤ Blend together.
			⑥ Shear into strained hot milk mixture.
Methocel F50 (Dow brand)	1.75 g	0.35%	⑦ Cool, and vacuum seal.
			⑧ Refrigerate milk foam for 12 h to hydrate.

SOUS VIDE TURNIP

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Turnips	200 g	100%	① Cut turnips into slices, 3 mm / ⅛ in thick.
			② Cut discs from each slice with 2.5 cm / 1 in pastry cutter.
Unsalted butter	25 g	12.5%	③ Vacuum seal discs in single even layer with butter, water, and salt.
Water	25 g	12.5%	
Salt	2 g	1%	④ Cook sous vide in 85 °C / 185 °F bath for 20 min.
			⑤ Refrigerate in bag.

CONSTRUCTED VEAL CREAM

Yields 360 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tapioca starch	11.2 g	4.5%	① Combine.
Salt	6 g	2.4%	
Whey protein isolate	6 g	2.4%	
Iota carrageenan	1 g	0.4%	
Acetic acid	0.5 g	0.2%	
Polysorbate 80	0.4 g	0.16%	
Xanthan gum	0.16 g	0.064%	
White veal stock, cold see page 2·296	250 g	100%	② Add to stock, and homogenize thoroughly.
			③ Warm mixture to 85 °C / 185 °F, and reserve at same temperature.
Rendered veal marrow	80 g	32%	④ Warm fat to 85 °C / 185 °F.
			⑤ Drizzle into hot stock mixture while blending until fully emulsified.
			⑥ Cool.
			⑦ Vacuum seal.
			⑧ Refrigerate.

For more on using a rotor-stator homogenizer, see the step-by-step procedure on page 4·236.

CHOUCROUTE ROYALE

Alder smoke, gin flavors, Munster, black trumpet mushroom

Choucroute garnie is a hearty winter feast of sauerkraut slowly cooked with onions, Alsatian Riesling, and goose or duck fat. It is topped with pork belly, ham hock, bacon, and sausages, then ringed with boiled potatoes. And if you start with homemade sauerkraut, it is especially delicious. The Greeks and Romans, and probably the Chinese before them, pickled cabbage. Medieval French and Germans fermented it instead, dramatically altering its flavor. How? The magic of bacteria. To ferment cabbage, you shred it, then salt it to extract enough liquid to submerge the cabbage in its own juices.

Protected from air, *Leuconostoc mesenteroides* bacteria flourishes. The microorganisms metabolize the natural sugars in the cabbage to create flavorful and preservative molecules, such as lactic acid. As acid levels increase, other beneficial bacteria begin to thrive. As they take over, they lower the pH further and finish developing the aroma and sour flavor of true sauerkraut.

Making sauerkraut at home is easy. Prepare the cabbage, set it outside in cool weather, and ignore it for two to three weeks. The transformation will be dramatic—in a wonderful way.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, cold smoker*
OPTIONAL EQUIPMENT:	*pressure cooker, vacuum reduction equipment*
TIME REQUIRED:	*72 h overall (3 wk if making your own salt-cured cabbage and rutabaga), including 13 h preparation and 1¼ h to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Cabbage Sauerkraut **optional, see page 3·351**	15 min	*2 wk**		160 g
Rutabaga Sauerkraut **optional, see page 3·351 or store-bought**	15 min	*2 wk**		100 g
Alsatian Munster Sausage	12 h	*12 h**	*30 min**	300 g
Brown Pork Stock **see page 2·296**	15 min	*2 h**		550 g
White Vegetable Stock **see page 2·296**	10 min	*3 h**		150 g
Smoked Pork Cheek **see page 38**		*24 h** and *48 h**	*20 min**	240 g
Quatre Épices **see page 2·403**	15 min			2 g
Aromatic Alsatian Mustard **optional**		*12 h** and *7 d**		160 g
Juniper Brine	10 min	5 min and *12 h**		600 g
Pork Tenderloin with Juniper	25 min	*12 h**	*1 h**	500 g
Pork Trotter Beignet	30 min	*3 h** and *4 h**	3 min	300 g
Braised Sauerkraut	15 min	1½ h	5 min	500 g
Sweet Potato Fondant	10 min	*45 min**	*10 min**	200 g

**(unattended times)*

ASSEMBLY:

Cook pork tenderloin sous vide in **60** °C / **140** °F bath to core temperature of **59** °C / **138** °F, about 50 min.

Cook sausage sous vide in **60** °C / **140** °F bath to core temperature of **59** °C / **138** °F, about 30 min, and then hold at temperature for 12 min to ensure full pasteurization.

While pork tenderloin and sausages are cooking:

Reheat pork cheek in **60** °C / **140** °F bath for 20 min.

Reheat sweet potato in **80** °C / **176** °F bath for 10 min.

Reheat sauerkraut on stove top over medium heat, about 5 min.

Adjust seasoning.

Heat frying oil for beignet cubes to **190** °C / **375** °F.

Deep-fry cubes for 1 min. Drain on paper towels.

To finish:

Slice sausages. Spoon sauerkraut into bottom of each bowl.

Dress with slices of sausage, pork cheek, pork tenderloin, and sweet potato fondant.

Serve beignets and Alsatian mustard on side.

For more on brines, see page 3·168.

JUNIPER BRINE

Yields 600 g

Juniper berries are traditionally used to flavor pork brines, but they are more famous as the flavoring used with gin.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	500 g	100%	① Combine.
Juniper berries, crushed	60 g	12%	② Bring to a boil, to dissolve salt fully.
Salt	35 g	7%	③ Cool, and infuse refrigerated for 12 h.
Coriander seeds	12 g	2.4%	④ Strain.
Lemon zest, grated	4 g	0.8%	
Angelica root, sliced	3.2 g	0.64%	
Bitter orange zest, grated	2.5 g	0.5%	
Malt, roasted	2 g	0.4%	
Hops	0.8 g	0.16%	
Cinnamon stick	0.4 g	0.08%	
Ginger, minced	0.4 g	0.08%	
Allspice berry	0.25 g	0.05%	

PORK TENDERLOIN WITH JUNIPER

Yields 500 g

It is important to trim the tenderloin to remove the tendon and silverskin membrane. The leeks then bond better, and the resulting medallions are much easier to eat.

Many plant foods can be infused with a gelatin solution, which provides ample protein to enable Activa to glue them to other protein-rich foods. Here we infuse the leeks so that we can bond them to the pork tenderloin and make a skin.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pork tenderloin, tendon and silverskin removed	500 g	100%	① Vacuum seal together. ② Refrigerate for 12 h.
Juniper brine, from above	200 g	40%	③ Drain, and refrigerate for 24 h.
Water, cold	100 g	20%	④ Disperse gelatin in cold water, and warm until fully dissolved.
160 Bloom gelatin	10 g	2% (*1%*)*	⑤ Reserve.
Leeks	300 g	60%	⑥ Peel away first layer, and discard. ⑦ Peel away next four layers, and cut into large sheets. ⑧ Vacuum seal leek sheets with gelatin mixture. ⑨ Steam for 4 min, then shock in ice water, and pat dry.
Activa RM	5 g	1%	⑩ Arrange sheets on plastic wrap to make single large sheet, overlapping sheets every 1 cm / ⅜ in. ⑪ Dust sheets evenly with Activa RM. ⑫ Roll brined pork in leek sheets, twisting ends of plastic wrap tightly to form roll. ⑬ Vacuum seal. ⑭ Refrigerate for 12 h to ensure leek wrapper adheres to pork.

(% of total weight of tenderloin, gin brine, water, and leeks*)

AROMATIC ALSATIAN MUSTARD OPTIONAL

Yields 245 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yellow mustard seeds	75 g	100%	① Blanch three times in scalding water, discarding water each time to remove bitterness.
Cider vinegar	190 g	253%	② Combine seeds with vinegar.
			③ Refrigerate for 12 h.
Fennel, brunoise	2.2 g	2.9%	④ Combine with soaked mustard seeds in food processor.
Tarragon, finely minced	1.5 g	2%	
Coriander seeds, ground	1.2 g	1.6%	⑤ Puree for 1 min to coarse texture.
Salt	1 g	1.33%	⑥ Vacuum seal mustard.
Black cardamom seeds, ground	0.8 g	1.1%	⑦ Refrigerate for at least 7 d.
Ground cinnamon	0.7 g	0.9%	
Ground cloves	0.7 g	0.9%	
Black pepper, ground	0.5 g	0.7%	
Bay leaf, finely minced	0.2 g	0.3%	

The mustard will keep indefinitely, and its flavor will improve with age.

SMOKED PORK CHEEK

Yields 240 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pork cheek, sinew removed	300 g (four cheeks)	100%	① Cold-smoke at 7 °C / 45 °F for 24 h and 50% relative humidity, which produces a wet-bulb temperature of 3 °C / 37 °F.
Alder wood chips	as needed		
Cherry wood chips	as needed		
Brown pork stock see page 2-296	150 g	50%	② Vacuum seal pork cheek with stock. ③ Cook sous vide in 68 °C / 154 °F bath for 48 h. ④ Cool, in bag, in ice-water bath, and refrigerate.

Alternatively, smoke cheeks in a conventional smoker for 2 h. The taste will be different but still good.

For more on cold-smoking, including a step-by-step procedure, see page 3-210.

PORK TROTTER BEIGNET

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brown pork stock see page 2-296	600 g	120%	① Reduce to 100 g, until glaze is achieved. ② Cool and reserve.
Water	1 kg	200%	③ Pressure-cook together at a gauge pressure of 1 bar / 15 psi for 2½ h.
Pork trotter	500 g	100%	
Pork snout	250 g	50%	④ Remove bones from trotter and snout, and separate skin and collagen from meat. ⑤ Dice skin and meat finely, keeping them separate. ⑥ Combine 120 g of meat and 30 g of skin, and reserve.
Shallots, minced	200 g	40%	⑦ Cook together until shallots and mushrooms are very tender, about 20 min.
Neutral oil	50 g	10%	
Black trumpet mushrooms, minced	40 g	8%	⑧ Remove from heat.
Cured ham, brunoise	40 g	8%	⑨ Fold into shallot mixture with cooked pork.
Grain mustard	10 g	2%	⑩ Whisk in pork glaze, from above.
Fine salt	2.2 g	0.44%	⑪ Cast onto silicone mat in layer 1.5 cm / ¾ in thick.
Black pepper, coarsely ground	0.2 g	0.04%	⑫ Refrigerate until set, at least 3 h. ⑬ Cut into cubes.
Nutmeg, grated	0.1 g	0.02%	
Eggs, whisked	200 g	40%	⑭ Dredge each beignet cube in Methocel K100M until evenly coated.
Dried brioche crumbs	100 g	20%	
Methocel K100M (Dow brand)	30 g	6%	⑮ Roll cubes in egg, and coat with brioche crumbs. ⑯ Refrigerate for at least 1 h before frying to firm crusts.

Removing bones from the pork trotter is easy, once it has been pressure-cooked.

BRAISED SAUERKRAUT

Yields 480 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	90 g	60%	① Sauté together, without allowing onions to color, until very tender, about 25 min.
Goose fat	75 g	50%	
Garlic, finely minced	30 g	20%	
Cabbage sauerkraut see page 3·351	150 g	100%	② Add to onion mixture.
Vegetable stock see page 2·296	150 g	100%	③ Cook until cabbage is very tender and liquid is reduced by half, about 30 min.
Riesling (dry)	105 g	70%	
Rutabaga sauerkraut see page 3·351	100 g	66.7%	
Muscat (dry)	50 g	33.3%	
Bay leaf	0.5 g	0.33%	④ Combine in sachet.
Black peppercorns	0.2 g	0.13%	⑤ Add sachet to onion-cabbage mixture, and continue to cook until most of liquid has evaporated, about 25 min.
Juniper berries	0.15 g	0.1%	
Cloves	0.1 g	0.07%	⑥ Remove sachet.
Coriander seeds	0.1 g	0.07%	
Salt	to taste		⑦ Season mixture.
			⑧ Cool and refrigerate.

Choucroute should be white. Many cooks use a pan that's too hot, scorching the sauerkraut and onions, or they add meat drippings. Instead, moisten the cabbage with colorless bouillon or chicken broth. Prevent browning by adding an acid, such as Riesling vinegar, while cooking.

Sauerkraut can keep for months and has plenty of vitamin C, which historically made it popular on navy ships for warding off scurvy. Researchers today are investigating whether it can reduce the risk of cancer, too.

SWEET POTATO FONDANT

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White sweet potatoes (satsuma-imo), peeled	175 g	100%	① Cut into tubes 6 cm / 2½ in tall with ring cutter, 4 cm / 1½ in. in diameter.
Water	125 g	71.4%	② Vacuum seal together with potatoes.
Unsalted butter, melted	27.5 g	15.7%	③ Cook sous vide in 95 °C / 203 °F bath for 45 min.
Salt	4.5 g	2.6%	④ Cool, in bag, in ice-water bath, and refrigerate.

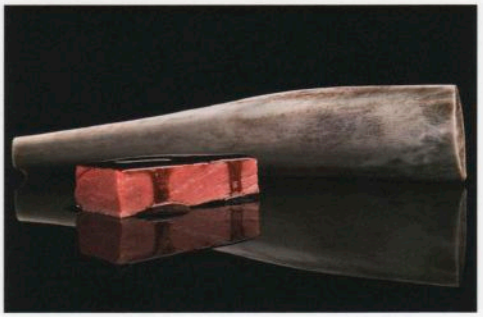
ALSATIAN MUNSTER SAUSAGE

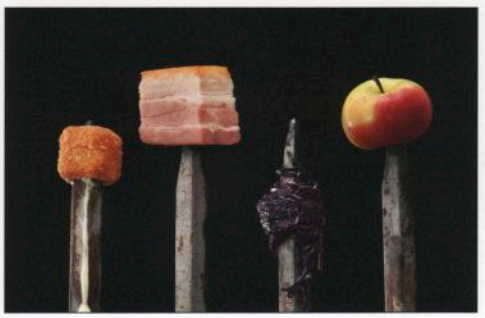
Yields 1.9 kg

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pork shoulder, cold	1,000 g	100%	① Cut each into 1 in cubes, then grind separately through 5 mm / ¼ in plate, and reserve separately.
Pork fat, semifrozen (–10 °C / 14 °F)	750 g	75%	
Salt	10 g	1%	② Combine with ground pork shoulder, and process using bowl chopper or food processor for about 6 min to puree; do not let temperature exceed 5 °C / 41 °F.
Insta Cure No. 1	10 g	1%	
Whole milk, frozen	100 g	10%	
Ground pork fat, from above	750 g	75%	③ Add to puree, and continue processing until smooth, about 3 min more. Allow temperature to rise to, but not exceed, 10 °C / 50 °F.
Alsatian Munster cheese, rind removed, grated	80 g	8%	
Sugar	7 g	0.7%	
Quatre épices, sifted see page 2·403	2 g	0.2%	
Black pepper, finely ground and sifted	1.5 g	0.15%	
Whole milk	150 g	15%	
Natural casings, 2.5 cm / 1 in. in diameter	as needed		④ Prepare, stuff, and link casings 10 cm / 4 in long and 3.75 cm / 1½ in thick.
			⑤ Hang sausages overnight in refrigerator.
			⑥ Cut into individual links.
			⑦ Vacuum seal without crushing, and refrigerate.

Although it might be tempting to grind the pork meat and fat together, do not do this because, for an emulsion-style sausage like this one, doing so will result in overchopping the fat and a greasy, incohesive sausage when cooked. For more details on this problem and sausage making in general see page 3·238.

TOUGH CUTS





BRAISED SHORT RIBS

Crispy beef and shallot salad with sweet, sour, and savory glaze

Short ribs are remarkable. They are flavorful and cheap, and, depending on how they are cooked, almost any texture is possible: chewy like a steak, falling-apart tender, or something in between. Traditional braising is subject to the vagaries of fluctuating oven or stove-top temperatures. Even seasonal variations in the same kitchen can wreak havoc on the outcome of a good braising recipe (see pages 2·96). But sous vide cooking takes the mystery out of braising short ribs, delivering the perfect texture every time. The succulent texture of the meat in this dish is contrasted with the intense crispness of fried beef strands.

YIELD: *10 portions*
SPECIAL EQUIPMENT: *sous vide equipment, blowtorch*
OPTIONAL EQUIPMENT: *pH meter*
TIME REQUIRED: *74 h overall, including 45 min preparation and 35 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
White Beef Stock see page 2·296	10 min	*2 h**		3.2 kg
Tamarind Paste see page 99	8 min	*30 min**		25 g
Braised Short Ribs	10 min	*72 h**	30 min	600 g
Sweet, Sour, and Savory Glaze	5 min	20 min	2 min	200 g
Dehydrated Garlic Chip optional	10 min	*12 h**		eight
Crispy Beef Strands see page 3·184	2 min	*48 h** and 10 min		80 g
Crispy Beef and Shallot Salad				100 g

**(unattended times)*

ASSEMBLY:

Reheat braised short ribs in 60 °C / 140 °F bath for 30 min.

While short ribs are reheating:

Preheat frying oil to 190 °C / 375 °F.
Refry beef strands in oil for 10 s to crisp and warm through.
Warm sweet, sour, and savory glaze.
Toss together crispy beef strands and fried shallots.
Combine crispy beef strands with chilies, scallions, lime zest, and herbs.
Season with lime juice and salt.
Remove short ribs from sous vide bags, and flash briefly with blowtorch to sear surface until golden, about 30 s.
Lacquer short ribs with warm glaze, place on plates.
Dress crispy beef strands and shallots with 10–15 g of sweet and sour glaze.
Finish with salad and a few freeze-dried garlic chips.

BRAISED SHORT RIBS

Yields 1.2 kg

This presentation starts with bone-in ribs, but virtually any means of cutting short ribs will work this way. Boneless short ribs benefit from Jaccarding. Although we prefer putting a bit of beef stock in the sous vide bag, the ribs can also be put in dry; considerable juice will emerge during the long cooking time.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Short ribs, four-bone plate with ribs 10–12.5 cm / 4–5 in long	3 kg	100%	① Remove fat cap and silver skin covering ribs. ② Vacuum seal ribs with beef stock.
White beef stock see page 2·296	225 g	7.5%	③ Cook sous vide in 60 °C / 140 °F bath for 72 h. ④ Chill vacuum-sealed ribs quickly in an ice-water bath. ⑤ Remove ribs from bag; strain juices, and reserve. ⑥ Peel meat from bones, and set on plates. ⑦ Trim gristle from meat, and cut meat into even block-shaped portions (about 10). ⑧ Vacuum seal, and refrigerate.

SWEET, SOUR, AND SAVORY GLAZE

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White beef stock see page 2·296	3 kg	100%	① Combine. ② Reduce until thick enough to coat back of spoon.
Short-rib cooking juices, from above	500 g	17%	
Cilantro leaves	20 g	0.7%	③ Add to hot, reduced mixture.
Star anise, crushed	5 g	0.2%	④ Infuse for about 5 min, or to taste.
Thai basil leaves	5 g	0.2%	⑤ Strain.
Tamarind paste, sieved see page 99	25 g	0.8%	⑥ Add three-fourths of each paste and sugar quantity to reduced mixture.
Palm sugar	8 g	0.3%	⑦ Adjust to taste with remainder of paste and sugar.
Salt	as needed		⑧ Season with salt.

CRISPY BEEF STRANDS

Yields 80 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Beef flank steak	200 g	100%	① Cut with grain into even, rectangular strips, 5 mm / ¼ in thick, and reserve.
Soy sauce	50 g	25%	② Combine, and place meat strips in marinade.
Fish sauce	34 g	17%	③ Vacuum seal, and refrigerate for 48 h.
Sugar	5.5 g	2.8%	④ Drain.
Salt	2 g	1.06%	⑤ Microwave strips at full power (800 W) until dry, 3–5 min.
			⑥ Pull strips apart, strand by strand.
Canola oil	as needed		⑦ Fry strands in 180 °C / 355 °F oil until dry. ⑧ Drain. ⑨ Reserve in airtight container with silica packets.

For more on this step-by-step procedure, see page 3·184.

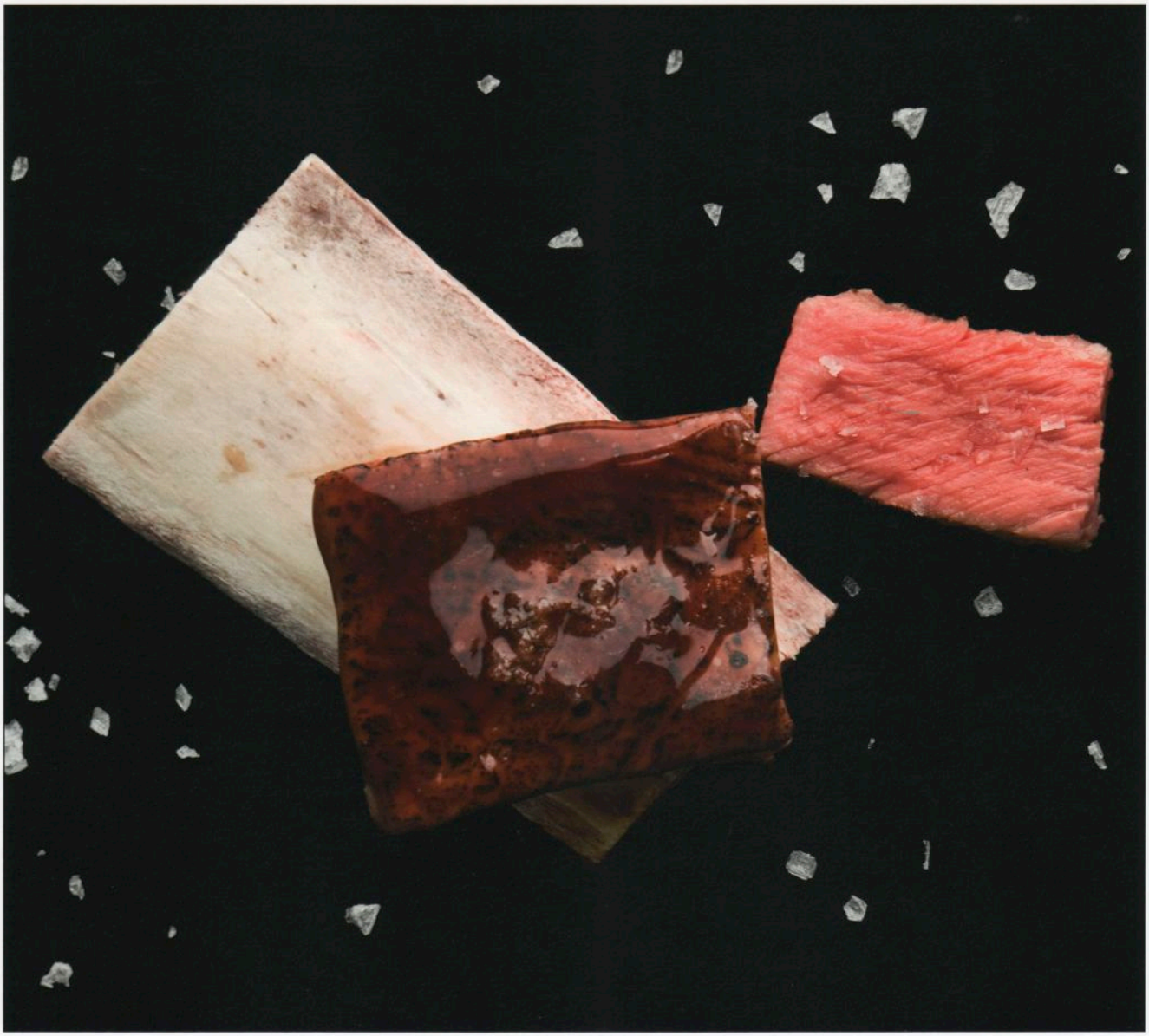
Beef strands (top) transform in the frying oil (middle) to a glassy crispness (bottom).

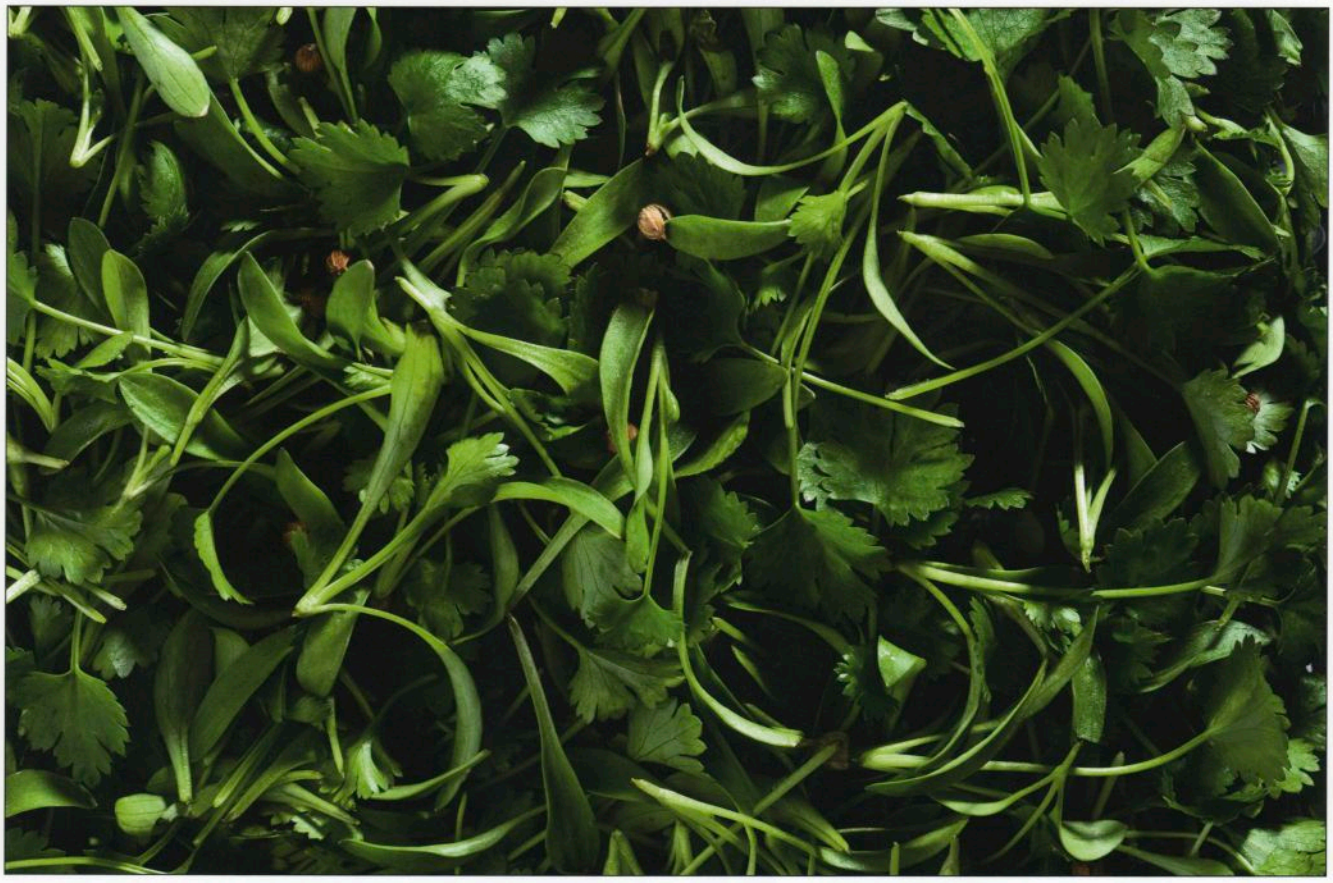
DEHYDRATED GARLIC CHIP

OPTIONAL

Yields several dozen slices

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Skim milk	350 g	350%	① Combine slices with of milk.
Elephant garlic cloves, sliced 1 mm / 1/32 in thick	100 g	100%	② Heat mixture to 70 °C / 160 °F.
			③ Remove immediately from heat, and cool.
			④ Drain, discarding milk.
			⑤ Rinse blanched garlic under running cold water.
Salt	as needed		⑥ Lay garlic slices in single layer on tray.
			⑦ Season.
			⑧ Dehydrate at 50 °C / 122 °F until dry, about 2 h.
			⑨ Reserve in airtight container with silica packets.





CRISPY BEEF AND SHALLOT SALAD

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Red shallots, sliced 1 mm / 1/32 in thick	50 g	100%	① Heat oil in deep fryer to 170 °C / 340 °F.
Canola oil	as needed		② Deep-fry shallot slices until dry and golden.
			③ Drain on paper towels.
Salt	as needed		④ Season slices.
			⑤ Reserve in airtight container with silica packets.
Sweet, sour, and savory glaze, from above	100 g	200%	⑥ Warm together, stirring to dissolve sugar.
			⑦ Cool.
Palm sugar	18 g	36%	⑧ Refrigerate.
Crispy beef strands, from above	80 g	160%	⑨ Measure and reserve individually.
Cilantro stems, 1 cm / 3/8 in lengths	3 g	6%	
Scallion, fine julienne	2 g	4%	
Small cilantro leaves	2 g	4%	
Small mint leaves	2 g	4%	
Small Thai basil leaves	2 g	4%	
Lime zest, fine julienne	1.5 g	3%	
Bird's eye chili, seeded and sliced paper-thin	1 g	2%	
Lime juice	to taste		
Salt	to taste		

POT-AU-FEU

Beef shank rillette, pickled veal tongue, rare flatiron steak, crispy ravigote

Pot-au-feu is so emblematic of French cuisine that the Larousse encyclopedia of 1867 states that "it is through it that we distinguish our national cuisine from all others." From its humble medieval origins as a communal pot of boiled meats, root vegetables, and broth, it became, during the late 17th century, the epitome of bourgeois cooking. Each successive generation of chefs has reinterpreted *pot-au-feu*, in culinary settings ranging from the corner bistro to the temples of haute cuisine. Alain Chapel substituted pigeon and fines herbes ravioli for the traditional beef shank and *sauce gribiche*. Michel Guérard served the dish with chicken, veal tongue, and beurre blanc. Eric Ripert breathed new life into it with king salmon, morels, and wild mushroom consommé. Our recipe is elaborate as well, yet we try to honor the modest origins of the dish even as we embrace the convenience of modern sous vide cooking.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, pressure cooker*
TIME REQUIRED: *4 d overall, including 1¾ h preparation and 30 min to reheat and finish*

ORDER OF PREPARATION:

		TIME TO		
COMPONENT	PREP	COOK	FINISH	QUANTITY
Glazed Oxtail		*100 h**	*20 min**	300 g
Brown Beef Jus see page 2·344	20 min	*4 h**		300 g
White Beef Stock see page 2·296	5 min	*2 h**		925 g
Sous Vide Veal Tongue	10 min	*24 h**	*20 min**	120 g
Rare Flatiron Steak	10 min	*12 h**	*20 min** and 2 min	160 g
Beignet of Sauce Ravigote	10 min	20 min and *5 h**	2 min	four cubes
Beef Shank Rillette	5 min	*5 h** and 10 min	*20 min**	120 g
Pot-au-Feu Consommé	20 min	*2½ h**	*20 min**	160 g
Sous Vide Root Vegetables	20 min	*40 min**	*20 min**	140 g
Microwave-Fried Parsley and Carrot Tops	5 min	4 min		20 g
Clove Oil	1 min			20 g

**(unattended times)*

ASSEMBLY:

Heat oil for beignets to **195** °C / **380** °F.
Reheat meats in **50** °C / **122** °F bath for 20 min, and reheat vegetables and consommé in **70** °C / **158** °F bath for 20 min.

While meat, vegetables, and consommé are reheating:
Deep-fry beignets until golden, about 1½ min.
Drain on paper towel–lined tray.
Sear flatiron cubes until just golden, about 30 s. Slice 1 cm / ⅜ in thick, and season with salt.
Arrange two tongue slices, three pieces of glazed oxtail, two flatiron slices, and one spoonful of warm beef rillette on each plate.
Garnish with warmed vegetables and fried parsley and carrot tops.
Drizzle with clove oil.
Serve consommé at table, with beignets on side.

GLAZED OXTAIL

Yields 325 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Oxtail, cut between joints	300 g	100%	① Vacuum seal.
Brown beef jus see page 2·344	75 g	25%	② Cook sous vide in 60 °C / 140 °F bath for 100 h.
			③ Remove oxtail and juices from bag.
			④ Dislodge pieces of meat from bones and gristle, and refrigerate meat.
			⑤ Strain cooking juices.
			⑥ Reduce juice to thick glaze. Glaze will thin when combined with oxtail pieces.
			⑦ Cool glaze.
			⑧ Vacuum seal oxtail pieces and glaze together.
			⑨ Refrigerate.

SOUS VIDE VEAL TONGUE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Veal tongues	550 g	100%	① Blanch for 2 min.
			② Drain and cool.
Water	100 g	18%	③ Combine with tongues.
Cider vinegar	45 g	8%	④ Vacuum seal together.
Carrot, peeled and thinly sliced	20 g	4%	⑤ Cook sous vide in 70 °C / 158 °F bath for 24 h.
			⑥ Remove tongues and cooking liquid from bag.
Garlic, thinly sliced	10 g	2%	⑦ Peel tongues, chill in cooking liquid, and slice thinly lengthwise.
Sweet onion, thinly sliced	10 g	2%	
Salt	7 g	1.3%	⑧ Reduce cooking liquid until syrupy, about 10 min.
			⑨ Strain and cool.
			⑩ Vacuum seal two tongue slices with one-fourth of reduced liquid into each of four bags.
			⑪ Refrigerate.

RARE FLATIRON STEAK

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Flatiron steak	500 g	100%	① Butterfly steak to remove tendon.
Activa RM or GS	as needed		② Dust each piece evenly with thin layer of Activa.
Salt	to taste		③ Fold steak closed.
			④ Vacuum seal together.
			⑤ Refrigerate for at least 6 h to ensure bonding.
			⑥ Cook sous vide in 55 °C / 131 °F bath for 12 h.
			⑦ Cool and refrigerate.

Flatiron steak is often sold with the tendon removed. In that case, you can either use the steak as is (skipping steps 2 and 3) or press two pieces together to make a steak as thick as the original.

For more on restructuring meat with Activa, see the step-by-step guide on page 3·250.

The cooking time at 55 °C / 131 °F can be extended from the 12 h suggested above to 24 h—or even 48 h. The longer the meat cooks, the more tender it will be.

BEIGNET OF SAUCE RAVIGOTE

INSPIRED BY WYLIE DUFRESNE

Yields 300 g (20 beignets)

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk, cold	50 g	100%	① Disperse gelatin and gellan in milk.
160 Bloom gelatin	5.5 g	11% (*2%*)*	② Boil for 3 min to fully hydrate.
			③ Refrigerate until set (about 5 min).
Low-acyl gellan (Kelcogel F, CP Kelco brand)	1.2 g	2.4% (*0.5%*)*	④ Puree until fluid.
Walnut oil	40 g	80%	⑤ Blend into milk fluid gel.
Lemon juice	35 g	70%	
Egg yolk, cooked sous vide in 65 °C / 150 °F bath for 35 min	33 g	66%	
Grapeseed oil	30 g	60%	
Dijon mustard	28 g	56%	
Vermouth vinegar	25 g	50%	
Sea beans, minced	30 g	60%	⑥ Prepare ingredients as noted.
Shallots, fine brunoise	25 g	50%	⑦ Fold all into fluid gel.
Chervil, finely minced	7 g	14%	⑧ Taste, and adjust seasoning.
Chives, finely minced	5 g	10%	⑨ Cast into mold in one layer, 2.5 cm / 1 in thick.
Parsley, finely minced	5 g	10%	⑩ Refrigerate for at least 5 h until set.
Salt	4.5 g	9%	⑪ Cut into cubes.
Black pepper, medium ground	0.5 g	1%	
All-purpose flour	100 g	200%	⑫ Roll cubes in flour, then in egg, and finally in panko, no more than 3 h before frying.
Egg, blended	50 g	100%	
Panko	50 g	100%	
Frying oil	as needed		⑬ Reserve.

(% of total weight of the first nine ingredients except the gelatin and gellan*)

For more on dispersing gels, see the step-by-step procedure on page 4·42.

For more on preparing fluid gels, see the step-by-step procedure on page 4·177.

BEEF SHANK RILLETTE

Yields 365 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Beef shank, boneless	200 g	100%	① Cook sous vide in 85 °C / 185 °F bath for 5 h. ② Cool quickly in ice-water bath. Shred meat.
White beef stock, cold see page 2-296	125 g	62.5%	③ Disperse agar and gelatin in stock. ④ Boil for 3 min to fully hydrate.
Agar	1.15 g	0.58% *(0.7%)**	⑤ Refrigerate until firmly set. ⑥ Puree until fluid.
160 Bloom gelatin	1.5 g	0.75% *(1.2%)**	
Rendered beef suet	40 g	20%	⑦ Heat fat until liquid is warm, but not hot. ⑧ Blend into stock fluid gel until fully emulsified. ⑨ Fold in shredded meat.
Black pepper	to taste		⑩ Season meat mixture generously, and vacuum seal.
Salt	to taste		⑪ Refrigerate.

(% of total weight of beef stock and beef suet*)

For more on strategies for rendering fat, see page 3-145.

POT-AU-FEU CONSOMMÉ

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Oxtail	300 g	40%	① Cut through center of bone and joints to release marrow.
Ground beef shank	750 g	100%	② Coat oxtail and ground beef shank with oil.
Neutral oil	75 g	10%	③ Roast in 190 °C / 375 °F oven, stirring often to ensure even browning, until golden brown, about 15 min.
Sweet onions, cut in half	280 g	37.3%	④ Prepare vegetables as noted.
Turnips, peeled and thinly sliced	200 g	26.6%	⑤ Sear onions on cut side until dark brown. ⑥ Sweat vegetables and garlic in suet until tender.
Leeks, thinly sliced	170 g	22.6%	
Celery root, peeled and thinly sliced	100 g	13.3%	
Garlic head, halved	70 g	9.3%	
Rendered beef suet	50 g	6.6%	
White beef stock see page 2-296	800 g	106.6%	⑦ Combine with roasted meats and vegetables. ⑧ Pressure-cook at a gauge pressure of 1 bar / 15 psi for 2 h. ⑨ Strain, discarding solids. ⑩ Clarify liquid with preferred method. ⑪ Reduce to 200 g, and remove from heat.
Carrot juice	350 g (from about 550 g carrots)	46.6%	
Parsnip juice	180 g (from about 650 g parsnips)	24%	
Black peppercorns	1.1 g	0.15%	⑫ Add to consommé. ⑬ Infuse at room temperature to desired flavor, about 5–7 min.
Cloves, whole	1 g	0.13%	
Allspice berries	0.55 g	0.07%	
Salt	to taste		⑭ Season. ⑮ Measure 160 g. ⑯ Vacuum seal and refrigerate.
Sherry vinegar	to taste		

For more on juicing strategies, see page 2-332.

For more on clarification and filtration strategies, see page 2-352.

For more on using extracts instead of whole spices, see page 2-288.

CLOVE OIL

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Grapeseed oil	100 g	100%	① Mix together and reserve.
Clove essential oil	0.5 g	0.5%	

SOUS VIDE ROOT VEGETABLES

Yields 170 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Unsalted butter	60 g	300%	① Prepare vegetables as noted.
Baby leeks, whites only	20 g	100%	② Vacuum seal vegetables individually with 10 g of butter.
Carrots, parisienne	20 g	100%	
Celery root, parisienne	20 g	100%	③ Cook each vegetable sous vide in 85 °C / 185 °F bath to desired texture, 25–40 min.
Red pearl onions	20 g	100%	
Rutabaga, parisienne	20 g	100%	
Turnips, parisienne	20 g	100%	

For more on cooking vegetables sous vide, see page 3·286.

MICROWAVE-FRIED PARSLEY AND CARROT TOPS

Yields 10 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Neutral oil	as needed		① Stretch plastic wrap over microwave-safe plate. Ensure that plastic is flush with bottom of plate and adheres tightly to plate's edges.
			② Brush thin film of oil on plastic wrap.
Young carrot tops	25 g	125%	③ Lay parsley leaves and carrot tops across plastic wrap.
Flat-leaf parsley leaves	20 g	100%	④ Brush parsley and carrot tops thinly with oil.
			⑤ Microwave on high for about 4 min until crisp, checking every 1½ min to prevent burning.
			⑥ Transfer to paper towel-lined tray.
Salt	to taste		⑦ Season carrot tops and parsley.
			⑧ Reserve in airtight container, preferably with silica gel packets.

Use only polyethylene-based plastic wrap for this recipe. Films based on polyvinyl chloride (PVC) could leach into the food when used this way.

For more on frying in a microwave oven, see page 3·312.

HUNGARIAN BEEF GOULASH

Wagyu beef cheek, sour cream Csipetke, compressed dill-pickled vegetables

"Without wishing to offend my colleagues abroad," once wrote Károly Gundel, arguably Hungary's greatest chef, "I feel obliged to state that with few exceptions, they ruin this excellent dish."

Goulash would seem simple. It originated in the 9th century, when shepherds cooked a thick version in a kettle over an open fire. Instead, it can be mystifying—is it a soup? Is it a stew? But in fact, there are certain unbendable rules to *gulyás*, this hearty soup of beef, onions, tomatoes, potatoes, and *csipetke* (pinched bits of dough similar to spaetzle). The rules: no flour; no spices other than sweet paprika and caraway; never frenchify with wine. And never, ever, serve with rice. This is what the restaurateur George Lang would tell you as well. He restored Károly's famous 1910 restaurant, Gundel, near Budapest. We do not wish to offend, but we snuck in black cumin and red wine vinegar to make the dish our own.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment*
OPTIONAL EQUIPMENT: *centrifuge*
TIME REQUIRED: *73 h overall, including 4 h preparation and 30 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Brown Beef Stock see page 2·296	30 min	*2 h**		800 g
Tomato Confit see page 62	30 min	*5 h**		100 g
Goulash Broth	15 min	*3½ h**	5 min	1 kg
American Wagyu Beef Cheek	5 min	*72 h**	*30 min**	450 g
Smoked Pepper Puree	10 min	*2 h**		50 g
Goulash Glaze		25 min	5 min	75 g
Sour Cream Spaetzle (Csipetke) see page 4·117	10 min	*12 h**	3 min	150 g
Compressed Dill-Pickled Vegetables	15 min			120 g
Rye Bread	12 h	*9 h**	3 min	600 g
GARNISH				
Dill				20 g

**(unattended times)*

ASSEMBLY:

Reheat beef cheeks in **62** °C / **144** °F water bath for 30 min.

While beef cheeks are reheating:

Cut bread into 3.5 cm / 1½ in wedges.

Toast wedges in beef marrow fat in nonstick frying pan until golden and crisp, about 2 min on first side and 1½ min on second side.

Sauté csipetke in clarified butter until golden. Drain on paper towels.

Warm goulash glaze and goulash broth.

Cut cheeks into slices, 1 cm / ½ in thick.

Brush with warm glaze.

Spoon smoked pepper puree onto each plate.

Top with three beef cheek slices.

Garnish with dill-pickled vegetables. Serve sautéed csipetke and toasted rye bread on side.

Pour broth at table.

GOULASH BROTH

Yields 1 kg

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tomato confit see page 62	100 g	17%	① Panfry together, stirring constantly to prevent burning, until dark, about 10 min.
Grapeseed oil	50 g	8.5%	
Red pepper juice	120 g (from 300 g red bell peppers)	20%	② Deglaze pan. ③ Scrape away and discard any bits on bottom of pan. ④ Measure 250 g of red pepper mixture, and reserve.
Red onions, thinly sliced	600 g	100%	⑤ Cook onions slowly in suet until deep amber and dry, about 45 min. If pan becomes too dry, add small amount of water to prevent onions from becoming too dark.
Rendered suet	100 g	17%	
Brown beef stock see page 2·296	800 g	133%	⑥ Combine all ingredients with both red pepper mixture and reduced onions.
Caraway seeds, toasted	3.5 g	0.6%	⑦ Vacuum seal.
Black peppercorns, toasted	3 g	0.5%	⑧ Cook sous vide in 85 °C / 185 °F bath for 2½ h.
Sweet paprika	2 g	0.3%	⑨ Strain through fine sieve.
Hot paprika	1.25 g	0.2%	⑩ Clarify with centrifuge at 27,500*g* for 1 h.
Black cumin seeds, toasted	0.5 g	0.08%	⑪ Refrigerate until chilled.
Cumin seeds, toasted	0.5 g	0.08%	⑫ Measure 25 g of goulash broth fat from surface of broth; reserve fat and broth separately.
Sherry vinegar	45 g	7.5%	⑬ Season broth.
Sugar	6 g	1%	⑭ Refrigerate broth and fat.
Salt	to taste		

For more on juicing strategies, see page 2·338.

For more on strategies for rendering fat, see page 3·145.

For more on clarification strategies, see page 2·352.

To see what happens to this broth when it is spun in a centrifuge, see page 2·361.

The highly marbled muscle of Wagyu beef cheek is perfect for long, slow braising. Beef cheeks from other breeds will also work in the recipe but will not be quite as rich as Wagyu. Why? See Chapter 11 on Meat and Seafood, page 312.

AMERICAN WAGYU BEEF CHEEK

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Wagyu beef cheeks, trimmed of sinew and silver skin	500 g	100%	① Vacuum seal together. ② Cook sous vide in 62 °C / 144 °F bath for 72 h. ③ Cool in ice-water bath, then refrigerate until needed.
Goulash broth, from above	75 g	15%	
Goulash broth fat, from above	25 g	5%	

SMOKED PEPPER PUREE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Goulash broth, from above	185 g	100%	① Vacuum seal together. ② Cook sous vide in 85 °C / 185 °F bath for 2 h. ③ Blend to fine puree. ④ Pass through fine sieve. ⑤ Measure 200 g of puree.
Red bell pepper, thinly sliced	30 g	16%	
Red onion, thinly sliced	23 g	12.5%	
Cured ham, thinly sliced	15 g	8%	
Smoked Hungarian paprika	8 g	4.5%	
Red wine vinegar	to taste		⑥ Season puree.
Salt	to taste		
Ultra-Sperse 5 (National Starch brand)	5.2 g	2.8% (*2.6%*)*	⑦ Whisk into puree. ⑧ Refrigerate.

**(% of total weight of pepper puree)*

GOULASH GLAZE

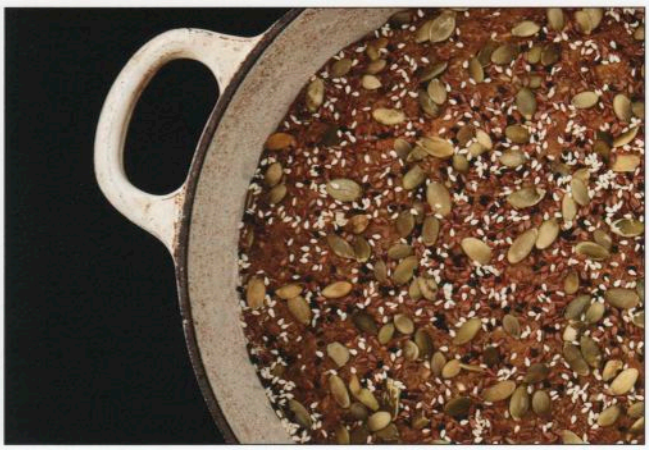
Yields 75 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Goulash broth, from above	400 g	100%	① Reduce to 75 g. ② Refrigerate until needed.

COMPRESSED DILL-PICKLED VEGETABLES

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Red bell peppers, seeded and peeled	100 g	33%	① Cut into fine julienne.
Cucumbers	175 g	58%	② Peel and slice on diagonal 1 mm / 1/16 in thick with mandoline. Yield is about 100 g.
Hon-shimeji mushrooms, caps only	100 g	33%	③ Bring water and salt to a boil.
			④ Blanch mushrooms in boiling salted water for 2 min.
Water	100 g	33%	⑤ Shock in ice-water bath.
Salt	2 g	0.67%	⑥ Drain and reserve.
Red pearl onions, peeled	150 g	50%	⑦ Cut in half lengthwise.
			⑧ Vacuum seal.
			⑨ Blanch in 95 °C / 200 °F bath for 4 min.
			⑩ Separate into petals, and reserve.
White wine vinegar	300 g	100%	⑪ Combine, and bring to a boil to make pickling brine.
Distilled water	150 g	50%	⑫ Pour approximately 100 g of brine over each vegetable: bell peppers, cucumbers, mushrooms, and onions.
Sugar	50 g	16.7%	
Dill	8.5 g	2.8%	⑬ Cool vegetables completely.
Salt	7.5 g	2.5%	⑭ Vacuum seal separately.
Black peppercorns	1.5 g	0.5%	⑮ Refrigerate.
Caraway seeds	1.5 g	0.5%	



SOUR CREAM SPAETZLE (CSIPETKE)

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sour cream spaetzle see page 4-117	150 g	100%	① Measure and reserve individually.
Clarified unsalted butter	45 g	30%	
Salt	to taste		

For more on clarifying butter, see page 4-213.

RYE BREAD ADAPTED FROM HORST BANDEL

Yields 1.25 kg

INGREDIENT	QUANTITY	SCALING	PROCEDURE
For the old rye bread soaker:			
Water, hot	870 g	483%	① Combine and cool to room temperature.
Day-old rye bread loaf (homemade or store-bought)	450 g	250%	② Vacuum seal. ③ Refrigerate for 12 h. ④ Squeeze out water. ⑤ Reserve for rye dough.
For the sourdough starter:			
Bread flour	200 g	111%	⑥ Mix together.
Water, 18 °C / 65 °F	100 g	56%	⑦ Ripen at 21 °C / 70 °F for 10–12 h.
Rye flour	75 g	42%	⑧ Measure 20 g of starter for rye dough.
Barley malt	10 g	5.5%	
Yeast (fresh)	5 g	2.8%	
For the cooked rye berries:			
Water	1 kg	555%	⑨ Vacuum seal together.
Rye berries, soaked for 12 h	250 g	139%	⑩ Cook sous vide in 90 °C / 194 °F bath for 5 h. ⑪ Drain. ⑫ Measure 180 g of cooked rye berries.
For the rye molasses meal:			
Old rye bread soaker, from above	180 g	100%	⑬ Combine in bowl. ⑭ Mix on medium speed with paddle attachment until mealy, about 2 min.
Blackstrap molasses	36 g	20%	
Sourdough starter, from above	20 g	11%	⑮ Reserve rye molasses meal.
Water	360 g	200%	⑯ Combine in bowl.
Yeast (fresh)	6 g	3.3%	
Rye molasses meal, from above	236 g	131%	⑰ Mix on low speed with paddle attachment for 10 min. Mixture should look sticky but not wet.
High-gluten flour	224 g	125%	⑱ Ferment for 30 min at 25–30 °C / 77–86 °F.
Rye chops (chopped rye berries)	224 g	125%	⑲ Transfer dough to cast-iron mold. ⑳ Ferment for 1 h at 25–30 °C / 77–86 °F.
Cooked rye berries, from above	180 g	100%	
Salt	12.2 g	6.8%	
Sesame seeds	as needed		㉑ Sprinkle seeds over fermented dough in mold.
Sprouted flaxseeds	as needed		㉒ Place uncovered mold on center rack of 220 °C / 425 °F oven, and bake for 10 min.
Sunflower seeds	as needed		㉓ Cover mold, and bake to core temperature of 99 °C / 210 °F, about 30 min. ㉔ Remove cover, and let rest in mold at room temperature for at least 2 h.
Rendered beef marrow	90 g	50%	㉕ Reserve.

If using instant yeast, reduce to one-third the amount shown for fresh yeast.

OSSO BUCO MILANESE

Marrow and coffee custard, braised pine nuts, kuri squash, gremolata crisp

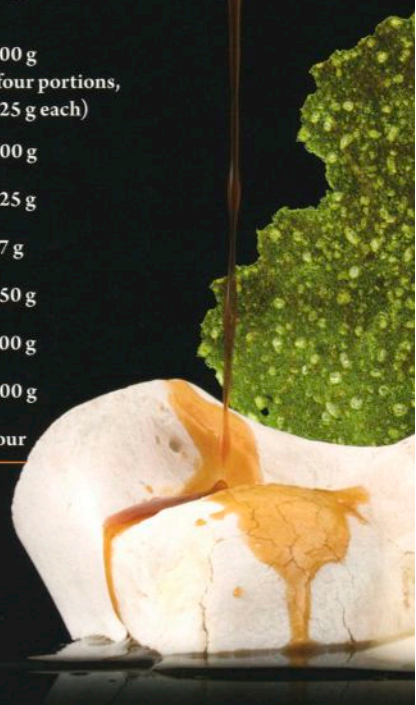
This classic dish of Lombardy has been around so long that it predates tomatoes in Italy, which were first documented in Europe by Dutch and Italian herbalists in the mid-16th century. Because they were members of the nightshade family, tomatoes were assumed to be poisonous, and another 150 years would pass before they appeared in a Neapolitan cookbook, in a sauce described as "Spanish style." Further north, in Milan, tomatoes were rarely eaten until a century later, which meant that osso buco was originally braised with cinnamon, allspice, and bay leaf—but no tomatoes. Today's version, with tomatoes, carrots, celery, and onion, is completely different. The highlight of the dish, the savory bone marrow, remains. Here, it becomes a custard spiked with coffee. Osso buco is traditionally served with saffron risotto. This risotto incorporates winter squash and replaces rice with pine nuts, a nod to elBulli chef Ferran Adrià, who has said of his creations, "Nothing is what it seems."

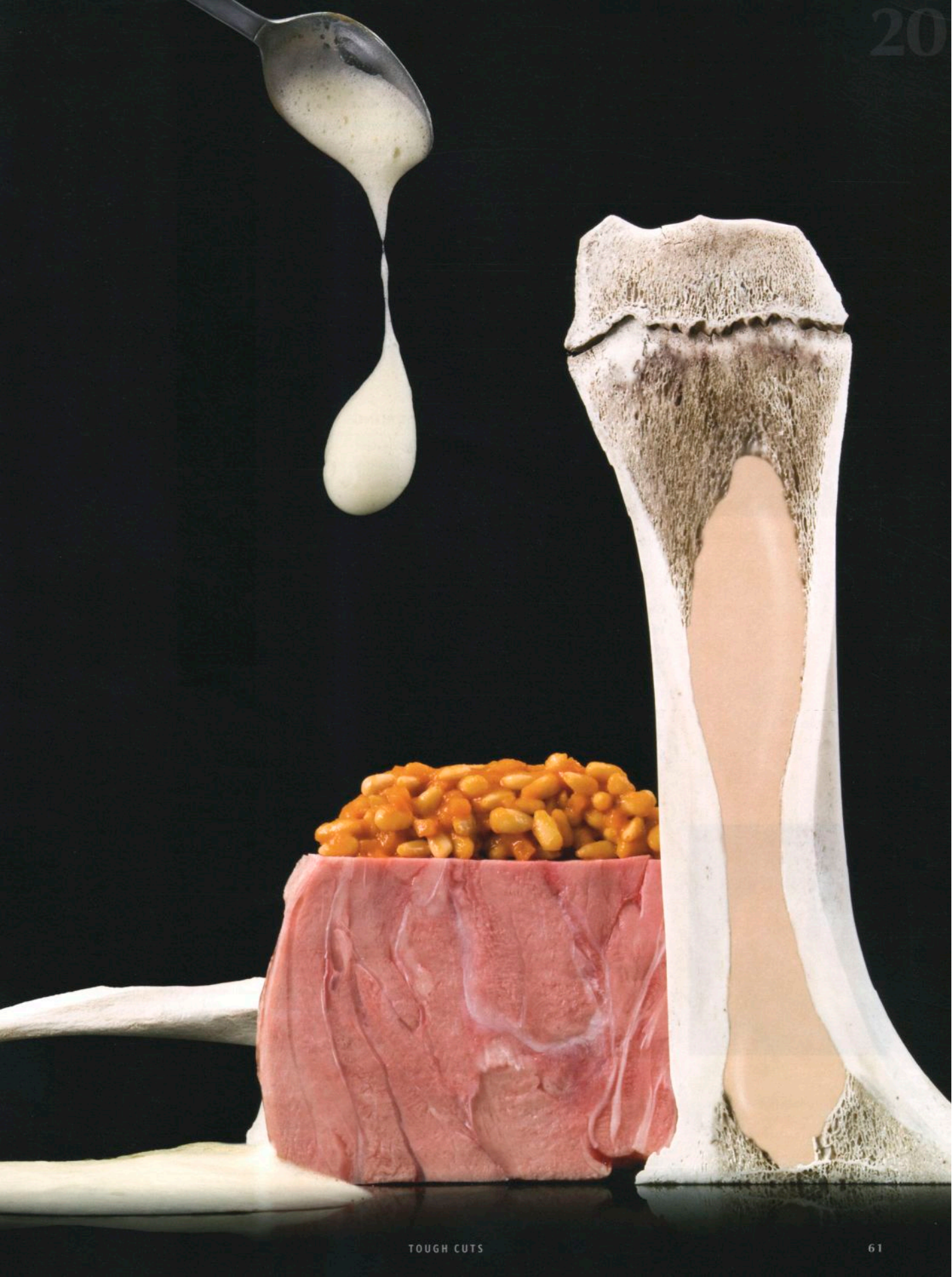
YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, pressure cooker, whipping siphon, vacuum reduction equipment*
OPTIONAL EQUIPMENT:	*centrifuge, combi oven or water-vapor oven, freeze dryer*
TIME REQUIRED:	*73 h overall, including 3¼ h preparation and 35 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
White Veal Stock see page 2·296	30 min	20 min and 2½ h*		1.1 kg
Garlic Confit see page 3·354	10 min	2 h*		15 g
Tomato Water see page 2·366	10 min	1 h*		1 kg
Braised Veal Foreshank	30 min	72 h	25 min	500 g (four portions, 125 g each)
Bone Marrow Custard	10 min	12 h* and 15 min	5–8 min	200 g
Tomato Vinegar Foam	10 min	12 h*	1 min	125 g
Tomato Confit	30 min	5 h*		17 g
Squash Glaze	45 min	1 h*	1 min	150 g
Pickled Butternut Squash	5 min	1 h*		100 g
Braised Pine Nuts with Winter Squash	15 min	1½ h*	3 min	500 g
Gremolata Crisp	10 min	45 min		four

*(unattended times)





ASSEMBLY:

Reheat braised veal shank portions in **62** °C / **144** °F bath for 25 min.

While meat is reheating:

Reheat bone marrow custard in combi oven set at **75** °C / **167** °F with 100% humidity for 8 min or water-vapor oven set comparably. If combi oven is unavailable, reheat in steamer for 5 min.

While custard is heating:

Whisk butter and olive oil into squash glaze, season with salt and lemon juice.

Heat tomato vinegar foam mixture to **35** °C / **95** °F.

Whip mixture with handheld wand mixer until thick foam forms. Allow foam to drain for 1 min before using.

Reheat braised pine nuts, and fold in kuri squash puree.

Fold in olive oil, cheese, and pickled squash, season with orange zest, black pepper, and salt.

Warm squash glaze.

Remove veal shank portions from bags, brush with glaze, and season with sea salt.

Arrange veal shank portion, marrow custard, and braised pine nuts on each plate.

Garnish veal with tomato vinegar foam and gremolata crisps.

TOMATO CONFIT ADAPTED FROM HESTON BLUMENTHAL

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tomatoes	1 kg	100%	① Core tomatoes.
			② Cut small X in blossom end of each tomato.
			③ Blanch until skin begins to lift at X, about 10 s.
			④ Shock in ice-water bath for 2 min. Peel off skins.
			⑤ Cut in half vertically, and scoop out seeds.
			⑥ Pat dry.
			⑦ Place cut side down on baking sheet lined with silicone mat, and reserve.
Glycerol	20 g	2%	⑧ Combine.
Water	20 g	2%	⑨ Brush evenly on tomatoes.
Extra-virgin olive oil	40 g	4%	⑩ Brush evenly on tomatoes.
Garlic, thinly sliced	15 g	1.5%	⑪ Sprinkle equally and evenly over tomatoes.
Thyme leaves	4 g	0.4%	
Bay leaves, finely sliced	1 g	0.1%	
Salt	2 g	0.2%	⑫ Season tomatoes evenly.
Sugar	2 g	0.2%	⑬ Dry in **110** °C / **225** °F oven for about 1 h.
			⑭ Turn tomatoes over, reduce heat to **95** °C / **200** °F, and dry until deep red and shriveled, 3–4 h. Cool.
			⑮ Discard dried herbs from tomatoes.
			⑯ Vacuum seal tomatoes and cooking oil.
			⑰ Refrigerate.

BRAISED VEAL FORESHANK

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Veal foreshank	1 kg (one whole)	100%	① Vacuum seal together.
Water	125 g	12.5%	② Cook sous vide in **62** °C / **144** °F bath for 72 h.
			③ Remove from bag, and cool in ice-water bath for 30 min.
			④ Divide meat into four equal portions, reserving cooking juices and bones.
			⑤ Vacuum seal meat portions individually, and refrigerate.
			⑥ Refrigerate cooking juices for making glaze, and reserve bones for making custard.
Flaky sea salt	to taste		⑦ Reserve.

See page 3·109 for cooking other tough cuts of meat that can be substituted for the veal shanks. Veal cheeks, veal breast, and pork or lamb shank are good options if veal shank is not available.

BONE MARROW CUSTARD

Yields 650 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Veal marrowbone (optional)	one foreshank bone		① Cut into four equal pieces, and reserve for casting custard. If not using bones, reserve other molds.
Water	500 g	400%	② Soak marrow in water for 12 h to remove blood.
Veal marrow	125 g	100%	③ Drain.
Whole milk, cold	125 g	100%	④ Disperse gelatin in milk.
160 Bloom gelatin	3.5 g	2.8% (*0.9%*)*	⑤ Vacuum seal with coffee beans.
			⑥ Cook sous vide in 75 °C / 167 °F bath for 10 min.
Coffee beans	1.5 g	1.2%	⑦ Strain, and reserve coffee-infused milk.
Salt	3 g	2.4%	⑧ Combine.
High-acyl gellan (Kelcogel LT100, CP Kelco brand)	0.55 g	0.44% (*0.15%*)*	
Low-acyl gellan (Kelcogel F, CP Kelco brand)	0.3 g	0.24% (*0.1%*)*	
White veal stock, warmed slightly see page 2·296	250 g	200%	⑨ Disperse gel mixture in stock.
			⑩ Blend stock with bone marrow, infused milk, and garlic confit.
Garlic confit, pureed see page 3·354	15 g	12%	⑪ Bring mixture to a boil, and simmer for 3 min.
			⑫ Pour quickly into marrowbones or other molds.
			⑬ Cool until set, about 5 min.
			⑭ Refrigerate.

(% of total weight of whole milk and white veal stock*)

SQUASH GLAZE

Yields 150 g

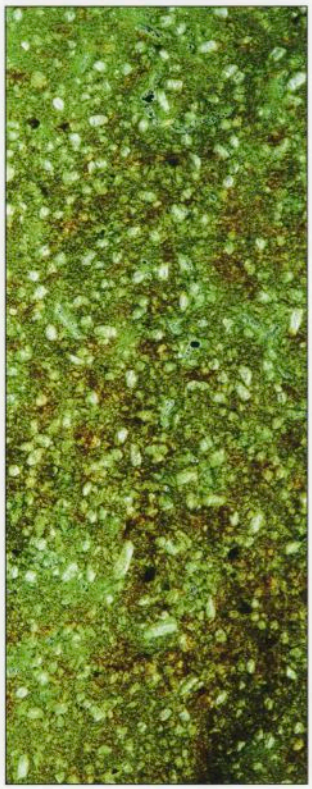
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Butternut squash juice	100 g (from 400 g squash)	17%	① Combine.
			② Bring to a simmer, and remove from heat.
Sweet onion juice	100 g (from 200 g onions)	17%	③ Strain through fine sieve to clarify.
Carrot juice	50 g (from 200 g carrots)	8.5%	
White veal stock see page 2·296	600 g	100%	④ Combine with strained vegetable juice, and blend until smooth.
Shank cooking juices, from above	100 g	17%	⑤ Reduce to 150 g.
			⑥ Cool.
Tomato confit, from above	7 g	1.2%	⑦ Refrigerate.
Unsalted butter, cubed	25 g	4%	⑧ Measure and reserve individually.
Extra-virgin olive oil	15 g	2.5%	
Lemon juice	to taste		
Salt	to taste		

For more on juicing strategies, see page 2·338.

PICKLED BUTTERNUT SQUASH

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Black peppercorns	3 g	3%	① Combine in sachet.
Coriander seeds, toasted	3 g	3%	
Star anise, lightly crushed	3 g	3%	
Orange zest, grated	2.5 g	2.5%	
Dried bitter orange peel	1.5 g	1.5%	
Saffron threads	0.1 g	0.1%	
White wine vinegar	130 g	130%	② Combine, and bring to a boil.
Water	80 g	80%	③ Remove from heat, and add sachet.
Sugar	30 g	30%	④ Infuse for 3 min to season.
Salt	1 g	1%	⑤ Discard sachet.
Butternut squash, brunoise	100 g	100%	⑥ Place in container. ⑦ Pour hot brine over squash. ⑧ Place open container in vacuum chamber, and pull vacuum several times to infuse squash thoroughly. ⑨ Vacuum seal, and refrigerate.



GREMOLATA CRISP

Yields: 135 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Parsley leaves	245 g	100%	① Blanch until tender, about 2 min.
Water	10 g	4%	② Blend with parsley to make fine puree. ③ Pass through fine sieve, and measure 85 g.
Water	120 g	49%	④ Cook rice until completely soft and mixture has consistency of porridge, about 35 min. ⑤ Puree in food processor, leaving small grain specks visible. ⑥ Cool, and measure 100 g.
Long-grain white rice	50 g	20%	
Rice puree, from above	100 g	41%	⑦ Combine.
Parsley puree, from above	85 g	35%	⑧ Place crisp base in siphon, and charge with two nitrous oxide cartridges.
Egg whites	75 g	30.6%	⑨ Dispense onto silicone mat, and spread evenly in thin layer.
Vodka	26 g	10.6%	⑩ Microwave at medium power, 400 W for 50–60 s to dehydrate. Sheet should be very crunchy.
Baking powder	5.2 g	2.1%	⑪ Break into uneven pieces.
Salt	2.2 g	1%	⑫ Store crisps in airtight container at room temperature.
Garlic powder	2 g	0.8%	
Lemon zest, grated	1.3 g	0.3%	
Lemon juice	0.5 g	0.2%	
Black pepper, coarsely cracked	0.4 g	0.16%	
Ascorbic acid	0.35 g	0.14%	
Lemon essential oil	0.1 g (two drops)	0.04%	

TOMATO VINEGAR FOAM

Yields 125 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tomato water see page 2·366	1 kg	100%	① Reduce to 125 g.
White wine vinegar	150 g	14%	② Add to reduced tomato water.
Salt	2.5 g	0.24%	③ Cool.
Saffron threads	1 g	0.1%	④ Vacuum seal.
			⑤ Refrigerate for 12 h to infuse.
Whey protein isolate	2 g	0.2%	⑥ Whisk into infused tomato water until dissolved.
Deoiled soy lecithin	1 g	0.1%	⑦ Refrigerate.

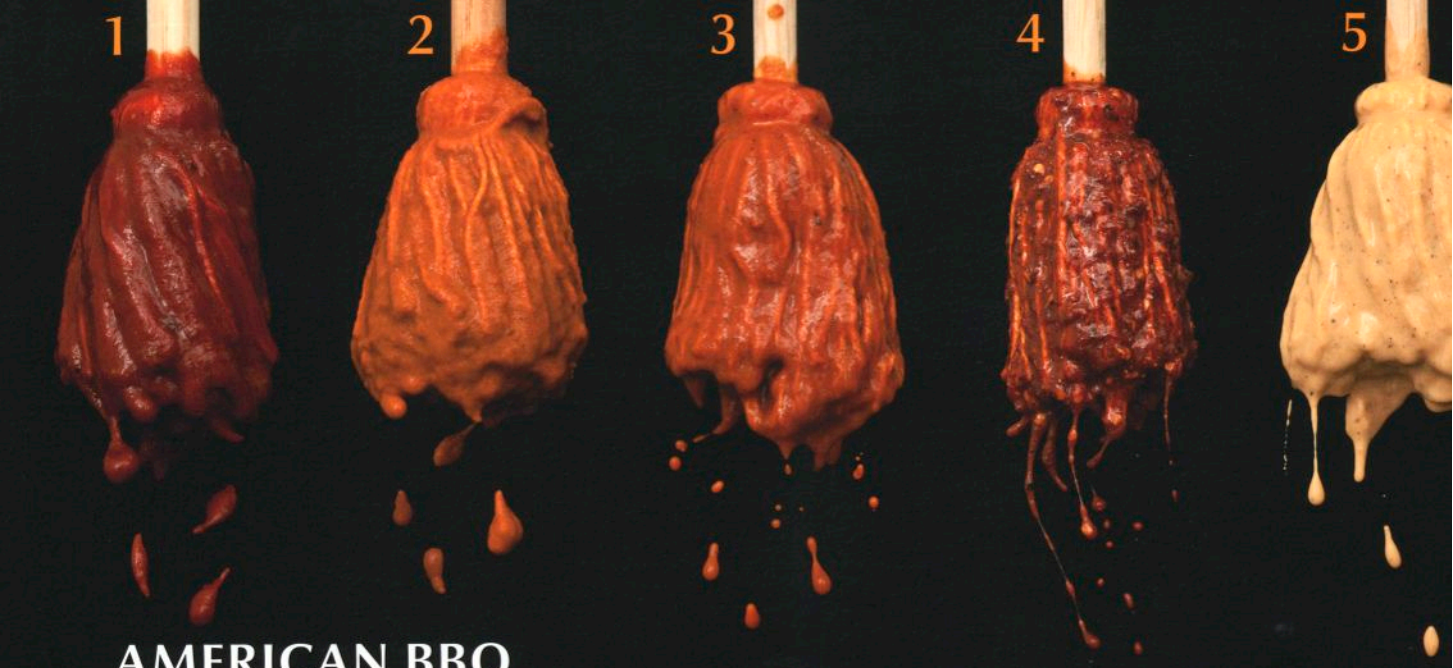
BRAISED PINE NUTS WITH WINTER SQUASH

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White veal stock see page 2·296	250 g	250%	① Puree until smooth, and reserve.
Tomato confit, from above	10 g	10%	
Kabocha squash juice	1 kg (from 4 kg squash)	1,000%	② Bring to a simmer, and remove from heat. ③ Strain through fine sieve to clarify, and reserve.
White wine (dry)	75 g	75%	④ Reduce to 50 g, about 5 min, and reserve.
Olive oil	25 g	25%	⑤ Sauté until tender.
Shallots, finely minced	25 g	25%	
Pine nuts, lightly toasted	100 g	100%	⑥ Add to shallots, and deglaze with wine reduction. ⑦ Add stock mixture and kabocha squash juice. ⑧ Pressure-cook at a gauge pressure of 1 bar / 15 psi for 7 min. ⑨ Cool. ⑩ Drain, reserving pine nuts and liquid separately. ⑪ Reduce liquid to form glaze. ⑫ Fold glaze into reserved pine nuts, and cool. ⑬ Vacuum seal, and refrigerate.
Kuri squash, peeled and cut into large dice	100 g	100%	⑭ Vacuum seal. ⑮ Cook sous vide in 90 °C / 194 °F bath for 1¼ h.
Extra-virgin olive oil	10 g	10%	⑯ Pass through fine sieve.
Salt	to taste		⑰ Season squash puree, and measure 80 g. ⑱ Vacuum seal. ⑲ Refrigerate.
Pickled butternut squash, drained, from above	100 g	100%	⑳ Measure and reserve individually.
Extra-virgin olive oil	15 g	15%	
Parmigiano-Reggiano, grated	12 g	12%	
Saffron threads	0.1 g	0.1%	
Black pepper, freshly ground and sifted	to taste		
Orange zest, grated	to taste		
Salt	to taste		

For more on juicing strategies, see page 2·338.

The red-orange color of winter squash, also a New World export to Italy, is reminiscent of the saffron traditionally used in *risotto alla Milanese*.



AMERICAN BBQ

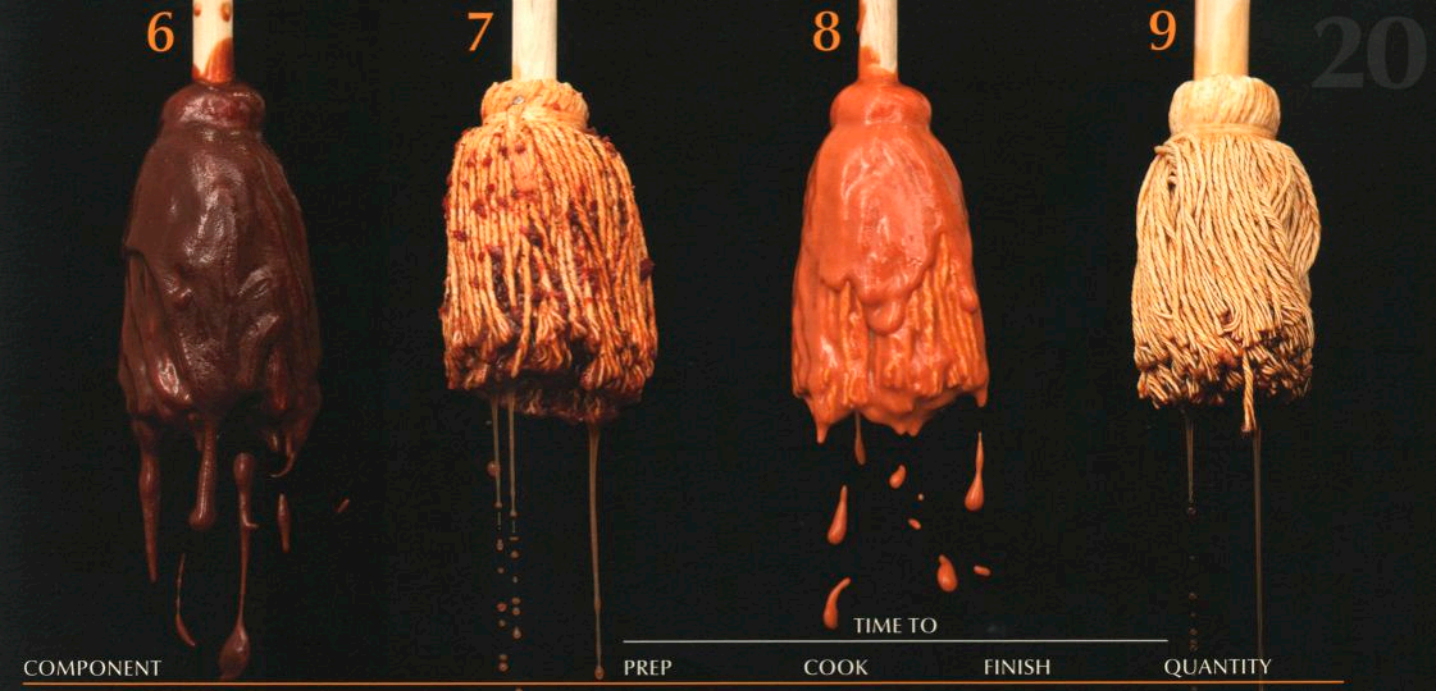
Certifiably nuts. That's a fair way to describe most people in the world of barbecue. We can say this because we're among them! Arguments among devotees attain religious fervor over the right kind of meat, the best wood, the rub, the pit (open or closed), whether the sauce is tart or acidic or spicy or has ketchup or mustard, or whether there's even a sauce at all … and what about the smoke ring?

Don't get us started. The true answer depends on where you fall on the map. If you're in East Texas, it's beef smoked over hickory wood with a sweeter sauce. If you're in the North Carolina Piedmont, it's pork shoulder and a thin, vinegar-based sauce. Barbecue is America's own regional cuisine. On page 3-218, we have a map of the various regions; here we have the recipes. Take your pick: we've got sauces and sides to showcase as many regions as we can.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*hot-smoker*
OPTIONAL EQUIPMENT:	*sous vide equipment, centrifuge, rotary evaporator, liquid nitrogen*
TIME REQUIRED:	*from 30 min to 80 h overall, including from 5 min to 2 h preparation and from 5 min to 40 min to reheat and finish*
SPECIAL CONSIDERATION:	*choose your meat, your sauce (if any), and your sides*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Memphis Rub	5 min			60 g
Kansas Rub	5 min			60 g
Kansas City BBQ Sauce (1 above)	15 min	20 min		250 g
East Texas BBQ Sauce (2)	15 min	20 min		200 g
Memphis BBQ Sauce (3)	15 min	20 min		250 g
North Carolina (Eastern Region) BBQ Sauce (4)	5 min	20 min		250 g
5. South Carolina BBQ Sauce (5)	15 min	20 min		325 g
Kentucky BBQ Sauce (6)	15 min	20 min		300 g
North Carolina (Lexington-style) BBQ Sauce (7)	5 min	20 min		to taste



COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
House BBQ Sauce (8) see page 4·67	25 min			300 g
Tomato Confit see page 62	20 min	*5 h**		155 g
Brown Beef Jus see page 2·344	10 min	*1½ h**		
Centrifuged BBQ Sauce (9)	15 min	20 min and *1 h**		150 g
Red Coleslaw	25 min	*2 h**		300 g
White Coleslaw				300 g
Pickled Pearl Onions see page 58	5 min	5 min		48 g
Potato Salad	15 min	12 min and *30 min**		600 g
Fried Green Tomatoes	10 min		2 min	250 g
Fried Pickles	5 min	30 min and *12 h**	2 min	250 g
Rémoulade Sauce	15 min			200 g
Corn Bread	15 min	40 min		1 kg
Brown Pork Stock see page 2·296	10 min	*2 h**		300 g
Baked Beans		*12 h** and *2 h**	2 min	700 g
Buttermilk Biscuits	20 min	15 min		500 g
MEATS				
Pulled Pork Shoulder		*7 h** and *72 h**	10 min	500 g
Pork Ribs		*7 h** and *48 h**	10 min	500 g
Beef Short Ribs		*7 h** and *72 h**	10 min	500 g
Beef Brisket		*4 h** and *72 h**	10 min	500 g

**(unattended times)*

MEMPHIS RUB

Yields 32.5 g

For our friends who think barbecuing is throwing a piece of meat on a flaming-hot grill: it's not. That's grilling. Barbecuing is done low and slow, with lots of smoke (see Smoking, page 2·132). In some places, you'd be laughed out of town or worse for suggesting otherwise.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet Hungarian paprika	12.5 g	100%	① Grind finely, and sieve.
Salt	7.5 g	60%	
Garlic powder	3 g	24%	
Chili powder (McCormick brand)	2.5 g	20%	
Onion powder	2.5 g	20%	
Sweet paprika	2.5 g	20%	
Black peppercorns	2 g	16%	

KANSAS RUB

Yields 60 g

Dry rubs are usually put on 12 hours before cooking. However, we also use them as a spice mix added at the end.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brown sugar	50 g	100%	① Grind finely, and sieve.
Salt	4%	8%	
Black pepper, ground	3.5 g	7%	
Chili powder (McCormick brand)	2.5 g	5%	
Sweet paprika	2.5 g	5%	
Garlic powder	1.5 g	3%	
Onion powder	1 g	2%	
Red chili, minced	1 g	2%	

KANSAS CITY BBQ SAUCE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ketchup (Heinz brand)	225 g	100%	① Mix in heavy-bottom pot.
Tomato paste	40 g	17.8%	② Simmer, stirring frequently to prevent sticking, until reduced to 250 g, about 20 min.
Water	40 g	17.8%	
White wine vinegar	40 g	17.8%	
Brown sugar	35 g	15%	
Black pepper, ground	5 g	2.2%	
Chili powder (McCormick brand)	5 g	2.2%	
Mustard powder	4.5 g	2%	
Salt	4.5 g	2%	
Cayenne pepper	4 g	1.8%	
Garlic powder	1 g	0.4%	
Onion powder	0.75 g	0.3%	
Ginger, peeled and finely minced	0.25 g	0.1%	
Cumin powder	0.1 g	0.05%	
Green Thai chili, minced	4 g	1.8%	③ Season sauce, and refrigerate.
Lemon juice	5.5 g	2.4%	
Salt	to taste		

EAST TEXAS BBQ SAUCE

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yellow onions, finely minced	135 g	169%	① Sweat until translucent and tender in heavy-bottom pot, about 7 min.
Unsalted butter	40 g	50%	
Garlic, finely minced	7 g	9%	
Distilled vinegar	80 g	100%	② Combine.
Water	80 g	100%	③ Add to onion mixture.
Ketchup (Heinz brand)	50 g	62.5%	④ Simmer, stirring frequently to prevent sticking, until reduced to 200 g, about 20 min.
Ancho chili paste	40 g	50%	
Worcestershire sauce	4 g	5%	
Chili powder (McCormick brand)	2 g	2.5%	
Mustard powder	2 g	2.5%	
Bay leaf, crushed	0.15 g	0.19%	
Cayenne pepper	0.5 g	0.6%	
Lemon juice	13.5 g	17%	⑤ Season sauce, and refrigerate.
Sugar	2 g	2.5%	
Salt	to taste		

MEMPHIS BBQ SAUCE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Canned tomatoes	300 g	100%	① Mix in heavy-bottom pot.
Cider vinegar	80 g	27%	② Simmer, stirring frequently to prevent sticking, until reduced to 250 g, about 20 min.
Lemon juice	40 g	13%	
Unsalted butter	40 g	13%	
Brown sugar	35 g	11.5%	
Worcestershire sauce	30 g	10%	
Chili powder (McCormick brand)	2.5 g	0.85%	
Black pepper, ground	1.5 g	0.5%	
Onion powder	1.5 g	0.5%	
Tabasco sauce	1 g	0.3%	
Mustard powder	0.75 g	0.25%	
Cayenne pepper	0.5 g	0.15%	
Salt	to taste		③ Season sauce, and refrigerate.
Lemon juice	to taste		

NORTH CAROLINA (EASTERN REGION) BBQ SAUCE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cider vinegar	200 g	100%	① Mix in heavy-bottom pot.
Distilled white vinegar	200 g	100%	② Simmer, stirring frequently to prevent sticking, until reduced to 250 g, about 20 min.
Maple syrup	30 g	15.5%	
Chili flakes	10 g	5%	
Black pepper, ground	3 g	1.5%	
Sugar	5 g	3%	
Salt	to taste		③ Season sauce, and refrigerate.

We like our BBQ sauce spicy, and the North Carolina sauce has a definite kick to it. For a milder flavor, reduce the chili flakes and black pepper by half.

SOUTH CAROLINA BBQ SAUCE

Yields 380 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Dijon mustard	300 g	100%	① Mix in heavy-bottom pot.
Lager beer	125 g	42%	② Simmer, stirring frequently to prevent sticking, until thick, about 380 g or 20 min.
Cider vinegar	30 g	10%	
Tomato puree	30 g	10%	
Brown sugar	15 g	5%	
Worcestershire sauce	10 g	3%	
Black pepper, ground	1.5 g	0.5%	
Garlic powder	1.5 g	0.5%	
Cayenne pepper	to taste		③ Season sauce, and refrigerate.
Cider vinegar	to taste		
Salt	to taste		

KENTUCKY BBQ SAUCE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ketchup (Heinz brand)	300 g	100%	① Mix in heavy-bottom pot.
Cider vinegar	60 g	20%	② Simmer, stirring frequently to prevent sticking, until reduced to 300 g, about 15 min.
Brown sugar	50 g	17%	
Molasses	30 g	10%	
Pineapple juice (fresh)	30 g	10%	
Bourbon (Wild Turkey)	25 g	8.5%	
Bacon fat	8 g	2.7%	
Worcestershire sauce	5 g	2%	
Unsalted butter	8 g	2.7%	③ Blend into warm mixture until fully emulsified.
Bourbon (Wild Turkey)	20 g	6.7%	④ Season sauce, and refrigerate.
Lemon juice	to taste		
Salt	to taste		

Kentucky BBQ is often made with mutton, but this sauce works with any meat.

NORTH CAROLINA (LEXINGTON-STYLE) BBQ SAUCE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cider vinegar	115 g	100%	① Mix in heavy-bottom pot.
Distilled white vinegar	115 g	100%	② Simmer, stirring frequently to prevent sticking, until reduced to 300 g, about 10 min.
Ketchup (Heinz brand)	70 g	61%	
Maple syrup	30 g	26%	
Sugar	9.5 g	8.5%	
Chili flakes	7 g	6%	
Black pepper, ground	4.5 g	4%	
Salt	to taste		③ Season sauce, and refrigerate.

CENTRIFUGED BBQ SAUCE

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tomato confit see page 62	125 g	100%	① Mix in heavy-bottom pot.
Brown beef jus see page 2-344	100 g	80%	② Simmer, stirring frequently to prevent sticking, until reduced to 250 g.
Malt vinegar	100 g	80%	③ Centrifuge at 27,500*g* for 1 h.
Smoked maple syrup (store-bought)	30 g	25%	④ Decant clear liquid, and discard oil and solids.
Yellow onion, minced	30 g	25%	
Bourbon (Wild Turkey)	25 g	20%	
Bacon, thinly sliced and rendered	15 g	12%	
Worcestershire sauce	15 g	12%	
Dark molasses	10 g	8%	
Dried smoked Hungarian pepper	8 g	6.5%	
Mustard powder	0.7 g	0.55%	
Liquid smoke (AroSmoke P50, Red Arrow brand)	0.05 g	0.05%	
Cayenne pepper	to taste		⑤ Season sauce, and refrigerate.
MSG	0.8 g		
Salt	to taste		

Some BBQ sauces are traditionally made thin. They stick to the meat better if you add 0.2% xanthan gum, relative to the total weight of the sauce. Blend the gum in after the final step in the sauce recipe.

RED COLESLAW

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Green apple juice, clarified	400 g	267%	① Combine.
Red cabbage juice, clarified	400 g	267%	② Vacuum concentrate, using vacuum reduction equipment, to 150 g, about 2 h.
Red wine vinegar	400 g	267%	
Honey	30 g	7.5%	③ Season juice reduction.
Black peppercorns, finely crushed	0.4 g	0.1%	
Salt	to taste		
Red cabbage, julienne	150 g	100%	④ Mix with juice reduction, and serve immediately.
Pickled mustard seeds see page 3-348	10 g	6.5%	

For more on clarification and filtration strategies, see page 2-352. For more on vacuum reducing, see page 2-382.

WHITE COLESLAW

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Buttermilk	60 g	40%	① Blend thoroughly to make dressing; use rotor-stator homogenizer, if available, for richer texture.
Grapeseed oil	29 g	19%	
White balsamic vinegar	20 g	13.5%	
Egg yolk, cooked sous vide in 65 °C / 149 °F bath for 35 min	19 g	12.5%	
Rendered bacon fat	9 g	6%	
Dijon mustard	7 g	5%	
Sugar	3 g	2%	② Season dressing.
Salt	to taste		
Savoy cabbage, fine julienne	150 g	100%	③ Mix together. ④ Let soften for 1 min.
Salt	1 g	0.5%	⑤ Toss with dressing.
Green apple, small dice	120 g	80%	⑥ Arrange on coleslaw.
Horseradish root, finely grated	2 g	1.5%	⑦ Serve immediately.
Celery seeds, lightly toasted	1.5 g	1%	

Coleslaw comes in many forms, thick or thin, sweet or astringent. We feel that the coleslaw must balance the richness of the barbecued meat, so our slaws are not very sweet.

For more on strategies for rendering fat, see page 3-145.

POTATO SALAD

Yields 600 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Fingerling potatoes	400 g	100%	① Toss together.
Salt	5 g	1.25%	② Cook sous vide in 88 °C / 191 °F bath for about 30 min (cooking time depends on size of potatoes).
			③ Cool in ice-water bath.
			④ Cut into halves or quarters, depending on size.
Crème fraîche	50 g	12.5%	⑤ Whisk together.
Muscat vinegar	20 g	5%	⑥ Mix gently with potatoes.
Walnut oil	15 g	3.75%	
French whole-grain mustard	4 g	1%	
Salt	2 g	0.5%	
Sugar	2 g	0.5%	
Egg yolk, cooked sous vide, at 68 °C / 154 °F for 35 min, cooled and quartered	80 g	20%	⑦ Fold gently into salad.
Pickled pearl onions, petals see page 3·348	48 g	12%	
Celery leaves, thinly sliced	3 g	0.75%	
Coriander seeds, toasted and crushed	2 g	0.5%	
Scallions, whites only	40 g (four pieces)	10%	⑧ Sauté over medium heat until tender.
			⑨ Arrange around salad.
Potato skins	200 g	50%	⑩ Toss potato skins with starch.
Potato starch	15 g	3.75%	⑪ Fry in 180 °C / 360 °F oil until golden and crisp, about 3 min.
Frying oil	as needed		
Salt	to taste		⑫ Toss with salt.
			⑬ Serve with salad.

Potato salad comes in many different styles. You won't see anything like the version here at a traditional barbecue pit, but it makes a great side dish.

FRIED GREEN TOMATOES

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Green tomatoes, cored	300 g	100%	① Blanch for 1 min.
			② Shock in ice-water bath.
			③ Peel off skins.
			④ Cut slices 8 mm / ⅝ in thick.
Cultured buttermilk	150 g	50%	⑤ Blend to make wash.
Eggs, blended	150 g	50%	
Cornmeal	100 g	35%	⑥ Mix to make cornmeal breading.
Panko	25 g	8.5%	⑦ Dredge tomato slices in wash.
Black pepper	0.8 g	0.25%	⑧ Coat slices with cornmeal breading.
Cayenne pepper	0.2 g	0.05%	
Canola oil	as needed		⑨ Deep-fry in 200 °C / 390 °F oil for 2 min.
			⑩ Drain on paper towels.
Salt	to taste		⑪ Season.

FRIED PICKLES

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	200 g	80%	① Mix to make batter.
All-purpose flour	130 g	52%	② Allow to rest at room temperature for 30 min.
Trisol (Texturas brand)	180 g	72% *(55%)**	
Yeast (fresh)	4 g	1.6% *(0.8%)***	
Salt	2 g	0.8%	③ Season batter.
Pickling cucumbers	250 g	100%	④ Cut into slices 6 mm / ¼ in thick.
White wine vinegar	200 g	80 g	⑤ Combine to make pickling liquid.
Water	150 g	60%	
Sugar	125 g	50%	
Salt	12.5 g	5%	
Garlic, thinly sliced	6.5 g	2.5%	
Celery seeds	0.5 g	0.3%	
Chili flakes	0.1 g	0.05%	
Dill	2 g	0.8%	⑥ Vacuum seal with cucumber slices and cooled pickling liquid.
			⑦ Refrigerate for at least 12 h.
Frying oil	as needed		⑧ Dip pickle slices in batter.
			⑨ Deep-fry in 200 °C / 390 °F oil for 2 min.
			⑩ Drain on paper towels.

(% of total weight of water and flour used for batter*)
**(*% of total weight of first three ingredients*)

RÉMOULADE SAUCE

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Mayonnaise store-bought or see page 4-226	90 g	100%	① Combine.
			② Refrigerate.
Lemon juice	55 g	60%	
Whole-grain mustard	31 g	35%	
Dijon mustard	17 g	20%	
Garlic clove, crushed	4 g	4.5%	
Green bird's eye chili (fresh), minced	3.5 g	4%	
Worcestershire sauce	2.5 g	2.5%	
Hot sauce	2 g	2%	
Hungarian sweet paprika	0.5 g	0.5%	
Celery, peeled and finely minced	30 g	35%	③ Fold into mayonnaise mixture just before serving.
Flat-leaf parsley, minced	4 g	4.5%	
Celery leaf, minced	2 g	2%	
Chives, minced	2 g	2%	
Black pepper, coarsely crushed	0.5 g	0.5%	
Salt	to taste		④ Season rémoulade.

What Southerners call rémoulade sauce is related to the classic French *sauce rémoulade* as well as to tartar sauce.

CORN BREAD

Yields 1 kg

There are many styles of corn bread across the United States. This version is nontraditional but has an amazing flavor and texture. Sieving out kernel skins is a nice, but optional, refinement.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Corn kernels (freshly cut)	560 g (from about six ears)	100%	① Sauté until browned, about 12 min.
Unsalted butter	150 g	27%	
Lard	100 g	18%	
Eggs, blended	100 g	18%	② Puree in blender.
Heavy cream	100 g	18%	③ Add sautéed corn.
Whole milk	50 g	10%	④ Pass through fine tamis to remove kernel skins (optional).
Flour	150 g	27%	⑤ Mix together.
Isomalt	140 g	25%	⑥ Fold in milk mixture.
Cornmeal	100 g	18%	⑦ Transfer to greased and floured loaf mold, filling half full.
Sugar	50 g	10%	
Baking powder	3.2 g	0.5%	⑧ Bake in 130 °C / 265 °F oven to core temperature of 88 °C / 190 °F, about 20 min.
Baking soda	1.75 g	0.3%	⑨ Rest at room temperature for 5 min.
Thyme leaves, chopped	to taste		⑩ Unmold, and slice to desired thickness.

1

2

4a

4b

7

10

BAKED BEANS

Yields 700 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Dry navy beans	200 g	100%	① Soak in water overnight in refrigerator. ② Rinse beans. ③ Place in fresh water, and pressure-cook at a gauge pressure of 1 bar / 15 psi for 25 min. ④ Cool in cooking water.
Brown pork stock see page 2·296	300 g	150%	⑤ Combine to make sauce. ⑥ Bring to boil. ⑦ Skim, and reduce to 250 g, or 150 g for thicker sauce. ⑧ Vacuum seal sauce with cooled beans. ⑨ Cook sous vide in 80 °C / 176 °F bath for 1 h.
Sweet onions, finely minced	65 g	32.5%	
Grade B maple syrup	40 g	20%	
Pomegranate molasses (store-bought)	30 g	15%	
Tomato confit see page 62	30 g	15%	
Bourbon (Wild Turkey)	20 g	10%	
Worcestershire sauce	18 g	9%	
Dijon mustard	15 g	7.5%	
Smoked Hungarian pepper, hydrated and sieved	8 g	4%	
Smoked ham hock meat, finely minced	60 g	30%	⑩ Add to cooked beans.
Salt	to taste		⑪ Season.
Sherry vinegar	to taste		

Maple syrup comes in several grades. Grade A is often considered the best, but for most cooking applications we prefer Grade B, which has a much stronger flavor.

BUTTERMILK BISCUITS

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White Lily biscuit flour	300 g	100%	① Mix together.
Baking powder	13.5 g	4.5%	② Sift.
Sugar	12 g	4%	
Salt	3 g	1%	
Unsalted butter	115 g	38%	③ Freeze butter; optionally, use liquid nitrogen.
Liquid nitrogen (optional)	as needed		④ Pulse in food processor until round balls form, 3 mm / ⅛ in. in diameter. ⑤ Toss into sifted flour mixture.
Heavy cream	115 g	38%	⑥ Mix together.
Crème fraîche	70 g	25%	⑦ Drizzle over flour mixture.
Egg, blended	30 g	10%	⑧ Mix very lightly until wet. ⑨ Place dough on plastic wrap. ⑩ Roll into log 8 cm / 3¼ in. in diameter; wrap in plastic. ⑪ Freeze partially. ⑫ Cut into round slices 2 cm / ¾ in thick. ⑬ Place slices on baking sheet lined with floured silicone mat. ⑭ Bake in 200 °C / 390 °F oven until golden on top, about 5 min. ⑮ Serve warm.

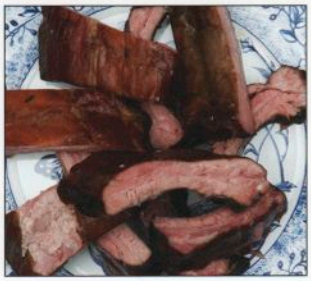
White Lily brand flour is milled from soft wheat. If unavailable, substitute another soft wheat flour or a pastry flour. If you use all-purpose flour, you may need to increase the amount of liquid slightly.

PULLED PORK SHOULDER

Yields 500 g

We find that the best flavor comes from smoking at a low temperature, and the best texture comes from long, controlled cooking sous vide. If your smoker does not control humidity, use an improvised wet-bulb thermometer to keep the temperature low, as described on page 3·211.

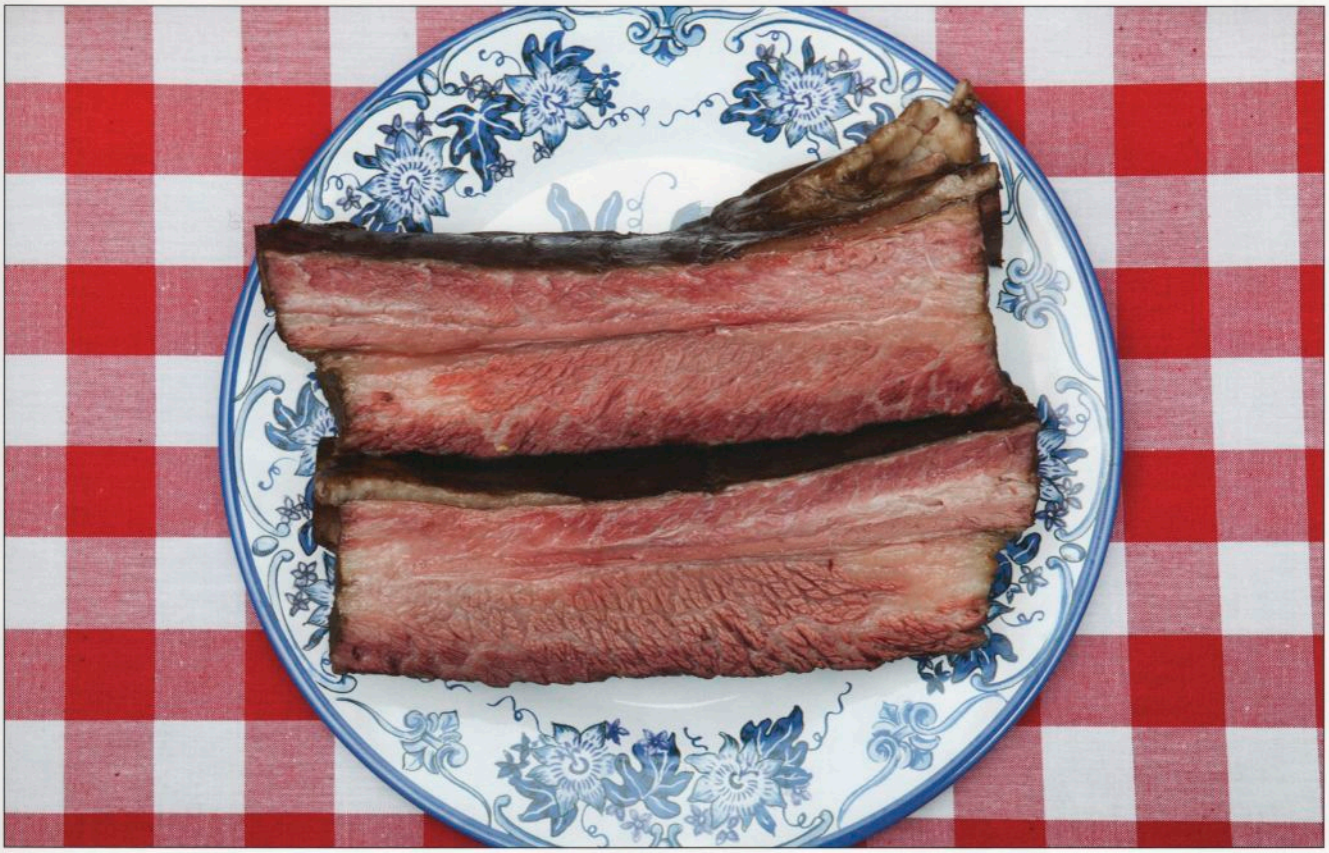
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pork shoulder, skin on, boneless	300 g	100%	① Smoke at 65 °C / 149 °F and 60% relative humidity (wet-bulb temperature 55 °C / 131 °F) for 7 h. ② Vacuum seal. ③ Cook sous vide in 65 °C / 150 °F bath for 72 h. ④ Pull meat apart with two forks, and discard pieces of fat.
BBQ sauce see page 4·49	300 g	100%	⑤ Mix into pulled meat.



PORK RIBS

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pork spare ribs, membrane removed	1.2 kg	100%	① Smoke at 65 °C / 149 °F and 60% relative humidity (wet-bulb temperature 55 °C / 131 °F) for 7 h. ② Vacuum seal. ③ Cook sous vide in 60 °C / 140 °F bath for 48 h.
Dry rub, from above	30 g	2.5%	④ Rub onto ribs just before serving. ⑤ Flash with blowtorch, or brown lightly if desired.

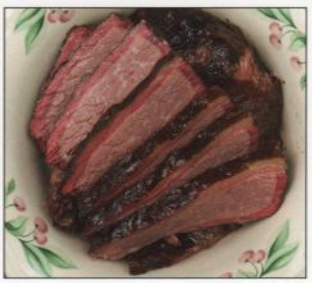


BEEF SHORT RIBS

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Beef short ribs	1.2 kg	100%	① Smoke at 65 °C / 149 °F and 65% relative humidity (wet-bulb temperature 55 °C / 131 °F) for 7 h. ② Vacuum seal. ③ Cook sous vide in 60 °C / 140 °F bath for 72 h. ④ Slide bones out while meat is warm. ⑤ Slice meat to serve.
East Texas BBQ sauce, from above	100 g	8%	⑥ Brush on sliced meat.

This brisket shows a highly developed smoke ring.



BEEF BRISKET

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Beef brisket	700 g	100%	① Smoke at 65 °C / 149 °F and 65% relative humidity (wet-bulb temperature 55 °C / 131 °F) for 7 h. ② Vacuum seal. ③ Cook sous vide in 63 °C / 146 °F bath for 72 h. ④ Trim off extra fat. ⑤ Slice meat to serve.
Kansas City BBQ sauce, from above	100 g	14%	⑥ Brush on sliced meat.

CASSOULET TOULOUSAIN (AUTUMN)

Tarbais beans, crispy duck tongues, Pyrenees ham infusion

Cassoulet, a rich, hearty casserole of beans, meat, and herbs, is nothing if not grounded in tradition. Three cities in southwestern France each guard their own regional 14th-century recipe with near-religious fervor. Bubbling in a rustic earthenware pot, cassoulet is cooked for many hours; French chefs speak of crafting it with love. So it's a little surprising that cassoulet also comes in cans and jars.

That's the inspiration for this version. White Tarbais beans are pressure-cooked, which, with the proper concentration and blend of salts in the water, renders the inside creamy and the skin taut. (Split skin can turn beans into goop.) The stew is completed by adding a rich ham broth with garlic sausage, duck confit, lamb shoulder, and, for gastronomic flourish, crispy duck tongues.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, centrifuge, pressure cooker*
TIME REQUIRED: *55 h overall, including 17 h preparation and 45 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Toulousain Garlic Sausage see page 3·238	30 min and *16 h**	*1 h 5 min**	*30 min**	160 g
Sous Vide Duck Confit Pavé	10 min	*6 h** and *48 h**	*15 min**	400 g
Pressure-cooked Tarbais Beans	10 min	1 h	2 min	80 g
Brown Lamb Stock see page 2·296	15 min	*2 h**		100 g
Braised Lamb Shoulder	5 min	*48 h**	*15 min**	400 g
Garlic Confit see page 3·354	5 min	*3 h**		30 g
Brown Pork Stock see page 2·296	15 min	*2 h**		700 g
Crispy Duck Tongues		*5 h** and *2 h**	1 min	65 g
Cured Ham Broth	10 min	1 h 5 min	2 min	60 g
GARNISH				
Thyme leaves				12 small
Bay leaf, julienne				2 g
Garlic confit see page 3·354				15 g

**(unattended times)*

ASSEMBLY:

Reheat duck confit, garlic sausage, and lamb shoulder in **56** °C / **133** °F bath, about 35 min.

Preheat griddle to **220** °C / **425** °F.

While meats are reheating:

Heat oil for duck tongues to **205** °C / **400** °F.

Deep-fry duck tongues until puffed and crispy, about 1 min. Drain on paper towels, and season with salt.

Warm ham broth and beans.

Sear garlic sausage, sliced 1 cm / ½ in thick, on griddle until golden on all sides.

Panfry duck confit (or use griddle), skin side only, until golden and crisp. Carve into slices 1.5 cm / ⅝ in thick.

Spoon beans into four shallow bowls.

Arrange lamb shoulder, sausage, and duck on beans.

Garnish with duck tongues, thyme, bay leaf, and garlic confit.

Pour ham broth at table.

TOULOUSAIN GARLIC SAUSAGE

Yields 750 g

Using polyphosphates can shorten presalting time. Alternatively, skip this step altogether by adding 0.25% Activa TI. For details, see page 3·250.

Goose or duck confit is the signature of this dish in the town of Castelnaudary, the self-proclaimed world capital of cassoulet. In Toulouse, it's sausage. Residents of Carcassonne replace the duck with partridge in their cassoulet.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Lean pork	735 g	100%	① Combine salt with lean meat, and refrigerate overnight.
Pork fatback, frozen	255 g	35%	② Grind meat and fat through 5 mm / 3/16 in grinding plate.
Salt	18 g	2.4%	
Garlic confit see page 3·354	30 g	4.1%	③ Combine ground meat, fat, and spices in a stand mixer.
Nutmeg, finely ground	1 g	0.14%	
Natural casings, 2.5 cm / 1 in diameter	as needed		④ Prepare, stuff, and link casings 10 cm / 4 in long. ⑤ Hang sausages overnight in refrigerator. ⑥ Cut two links, and vacuum seal, without crushing. ⑦ Cook garlic sausage sous vide in 59 °C / 138 °F bath to core temperature of 58 °C / 136 °F, about 35 min. Hold at that temperature for 30 min to pasteurize. ⑧ Cool in ice-water bath, and refrigerate.

SOUS VIDE DUCK CONFIT PAVÉ

Yields 850 g

Activa does not need to rest while bonding because it will hot-set while cooking. The vacuum packaging holds it together.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Salt	200 g	24.5%	① Combine.
Allspice berries	10 g	1.2%	② Grind coarsely to form rub.
Thyme	8 g	1%	
Garlic, thinly sliced	5 g	0.6%	
Star anise	1.9 g	0.23%	
Rosemary	1 g	0.12%	
Bay leaves	0.9 g	0.11%	
Black pepper	0.8 g	0.1%	
Coriander seeds	0.8 g	0.1%	
Orange zest, grated	0.1 g	0.01%	
Duck legs, boneless	825 g	100%	③ Coat duck legs with rub. ④ Cure in refrigerator for 6 h. ⑤ Rinse legs, and pat dry on paper towel–lined tray.
Activa RM	8 g	1% *(1%)**	⑥ Dust meat side of cured duck legs with Activa RM. ⑦ Pack together, with skin sides facing out, in mold, 10 cm by 20 cm / 4 in by 8 in and 5 cm / 2 in deep. ⑧ Vacuum seal. ⑨ Cook sous vide in 60 °C / 140 °F bath for 48 h. ⑩ Refrigerate.

**(% of total weight of cured duck legs)*

PRESSURE-COOKED TARBAIS BEANS

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	40 g	27%	① Sweat in pressure cooker until onions are translucent.
Bacon, thinly sliced	30 g	20%	
Rendered duck fat	10 g	7%	
Garlic, thinly sliced	5.5 g	3.7%	
Thyme	0.5 g	0.3%	
Black pepper, cracked	0.2 g	0.13%	
Brown pork stock see page 2·296	400 g	267%	② Deglaze pressure cooker.
Dry tarbais beans (or navy beans)	150 g	100%	③ Add to onion mixture.
Calcium chloride	1 g	0.67%	④ Pressure-cook at a gauge pressure of 1 bar / 15 psi for 45 min.
			⑤ Cool.
			⑥ Refrigerate.

The beans and sauce can be sealed inside a suitable retort bag or canning jar prior to pressure-cooking. This allows them to be stored unrefrigerated after cooking.

For more on canning, see page 2·75.

BRAISED LAMB SHOULDER

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Lamb shoulder, boneless	500 g	100%	① Vacuum seal.
Brown lamb stock see page 2·296	100 g	20%	② Cook sous vide in 56 °C / 133 °F bath for 48 h.
			③ Cool in ice-water bath.
Rendered duck fat	50 g	10%	④ Refrigerate.
Garlic, thinly sliced	9 g	1.8%	
Thyme	0.4 g	0.08%	
Salt	to taste		⑤ Reserve.

CRISPY DUCK TONGUES

Yields 65 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	250 g	167%	① Vacuum seal.
Duck tongues	150 g	100%	② Cook sous vide in 88 °C / 190 °F bath for 5 h.
Salt	5 g	3%	③ Remove from bag, and pull out central bone from each tongue while warm.
			④ Dehydrate tongues in 50 °C / 120 °F oven until completely dry, about 2 h.
			⑤ Vacuum seal loosely, and refrigerate.
Frying oil	as needed		⑥ Reserve.

CURED HAM BROTH

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	50 g	16.7%	① Sauté until translucent.
Olive oil	25 g	8.3%	
Leeks, thinly sliced	21 g	7%	
Dry-cured ham, thinly sliced	50 g	16.7%	② Add to onion mixture, and sauté for 5 min.
Garlic, thinly sliced	5.5 g	1.8%	
Brown pork stock see page 2·296	300 g	100%	③ Combine with onion and ham mixture.
			④ Pressure-cook at a gauge pressure of 1 bar / 15 psi for 1 h.
Salt	1.2 g	0.4%	
Thyme	0.3 g	0.1%	⑤ Strain through fine sieve, and cool.
			⑥ Season.
			⑦ Refrigerate.

Spring cassoulet replaces duck tongues and confit with duck ham, among other changes from the autumn version.

CASSOULET TOULOUSAIN (SPRING)

Fresh shell beans, duck ham, spring garlic consommé

After a winter of rich, fatty foods, something less heavy is in order. Fresh beans plucked from a sunny garden. Milk-fed baby lamb or spring lamb. Early green garlic. A more delicate pork sausage. A sprightly consommé. This lively and light reworking of the traditional autumn cassoulet (page 81), served cold, is perfect for late spring and takes one-quarter of the time to prepare. Traditionalists may say that this is not really cassoulet, but we think they would agree that this dish is delicious.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, pressure cooker*
OPTIONAL EQUIPMENT:	*centrifuge*
TIME REQUIRED:	*20 h overall, including 5¼ h preparation and 10 min to finish*
SPECIAL CONSIDERATION:	*serve cold*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Green Garlic and Pork Sausage	30 min and *4 h**	*12 h** and *35 min**	1 min	200 g
Sous Vide Duck Ham	15 min	*12 h** and *6 h**	2 min	100 g (four portions, 25 g each)
Spring Garlic Consommé	10 min	*1 h** and *1 h**		200 g
Country Bread Crisps	5 min	*1 h** and *30 min**		four crisps
Poached Lamb Loin	5 min	*40 min**	1 min	200 g
Fresh Bean Salad	20 min	*20 min**		100 g
GARNISH				
Summer savory leaves				12 small
Wood sorrel leaves				12 small

**(unattended times)*

ASSEMBLY:

Slice duck ham into sheets 1 mm / 1/16 in thick, lamb loin into slices 5 mm / ¼ in thick, and sausage, on diagonal, into slices 1 cm / ⅜ in thick.

Toss cooked beans and peas with other salad elements.

Season.

Arrange slices of lamb, duck ham, and sausage on each plate.

Finish with bread crisps.

Pour consommé at table.

Legend has it that cassoulet was created during the 14th-century siege of Castelnaudary, in the Languedoc-Roussillon region of the south of France. Citizen soldiers needed a hearty meal to give them strength to fight. They got cassoulet, but they lost nevertheless.

GREEN GARLIC AND PORK SAUSAGE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pork shoulder, boneless	250 g	100%	① Cut into cubes.
Fatback	80 g	32%	② Toss with meat and fat cubes, and refrigerate for 4 h.
Salt	4.5 g	1.8%	③ Grind all cubes through 5 mm / ¼ in grinding plate.
Nutrifos 088, dissolved in small amount of warm water	0.66 g	0.26% *(0.2%)**	
Green garlic, blanched and finely minced	8 g	3.2%	④ Mix thoroughly with ground pork mixture.
			⑤ Form into sausages 3.75 cm / 1½ in. in diameter and 10 cm / 4 in long by using plastic wrap to mold the meat mixture.
			⑥ Mature links overnight in refrigerator.
			⑦ Vacuum seal, and cook sous vide in 61 °C / 142 °F bath to core temperature of 60 °C / 140 °F, about 45 min.
			⑧ Cool in ice-water bath, and refrigerate.

(% of total weight of pork shoulder and fatback)

For more on grinding coarse sausages, see page 3·225.

Spring garlic

SPRING GARLIC CONSOMMÉ

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Carrots, thinly sliced	80 g	40%	① Sauté until onions are translucent.
White onions, thinly sliced	80 g	40%	
Unsalted butter	25 g	12.5%	
Duck meat, ground	350 g	175%	② Combine with carrots and onions.
Water	200 g	100%	③ Pressure-cook for 1 h at a gauge pressure of 1 bar / 15 psi.
Black peppercorns	0.2 g	0.1%	
			④ Strain through fine sieve.
			⑤ Centrifuge at 27,500*g* for 1 h.
			⑥ Strain, and measure 100 g of consommé.
Green garlic spears	200 g	100%	⑦ Blanch for 3 min.
			⑧ Puree.
			⑨ Centrifuge at 27,500*g* for 1 h.
			⑩ Reserve resulting clear juice, and measure 20 g.
			⑪ Whisk into consommé base.
Lime juice	to taste		⑫ Season consommé.
Salt	to taste		⑬ Vacuum seal.
			⑭ Refrigerate.

For more on centrifuging and alternative clarification strategies, see page 2·352.

COUNTRY BREAD CRISPS

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brioche	100 g	100%	① Cut away crust.
			② Wrap in plastic wrap, and freeze.
			③ Cut on meat slicer into slices 1 mm / 1/16 in thick.
Rendered duck fat, warm	10 g	10%	④ Brush brioche slices with duck fat, and bake in 110 °C / 230 °F oven until golden and dried, about 30 min.
Salt	1 g	1%	
			⑤ Season with salt.
			⑥ Store in airtight container in cool, dry environment.

SOUS VIDE DUCK HAM ADAPTED FROM WYLIE DUFRESNE

Yields 750 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Salt	18 g	1.2%	① Combine to make cure.
Insta Cure No. 1	7.5 g	0.5%	
Duck thighs, boneless and skinless	1.5 kg	100%	② Coat duck pieces with cure.
Warm water	100 g	6.7%	③ Combine to prepare slurry.
Activa GS or RM see page 3·250	25 g	1.7% *(25%)**	④ Brush cured duck pieces with mixture. ⑤ Place duck pieces in terrine. ⑥ Vacuum seal. ⑦ Refrigerate terrine for 12 h. ⑧ Cook sous vide in 69 °C / 156 °F bath for 6 h. ⑨ Top sealed terrine with weight to flatten. ⑩ Refrigerate until cool. ⑪ Freeze.

**(% of total weight of water)*

POACHED LAMB LOIN

Yields 320 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	500 g	143%	① Combine to make brine.
Salt	35 g	10%	
Lamb loin, silver skin removed	350 g	100%	② Vacuum seal lamb in brine, and refrigerate for 4 h. ③ Rinse lamb, and pat dry on paper towel–lined tray. ④ Vacuum seal, and cook sous vide in 58 °C / 136 °F bath to core temperature of 57 °C / 135 °F, about 40 min. ⑤ Cool.
Extra-virgin olive oil	50 g	14%	⑥ Vacuum seal with cooled lamb. Refrigerate.

FRESH BEAN SALAD

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Fava beans, shelled and peeled	25 g	100%*	① Vacuum seal peas and each type of bean individually. ② Cook sous vide in 88 °C / 190 °F bath for 20 min, or to desired doneness. ③ Cool in ice-water bath. ④ Cut beans crosswise into 2.5 cm / 1 in pieces. ⑤ Combine. ⑥ Refrigerate.
English peas, shelled and peeled	20 g		
Romano beans, trimmed	15 g		
Green beans, trimmed	14 g		
Yellow wax beans, trimmed	14 g		
Roasted-hazelnut oil	7 g	8%	⑦ Measure and reserve individually.
Purslane leaves	7 g	8%	
Vermouth vinegar (or other semisweet white vinegar)	5 g	5.7%	
Scallion, thinly sliced	4 g	4.5%	
Lime juice	3 g	3.4%	
Salt	to taste		
Black pepper	to taste		

**(100% is the total weight of all beans used)*

For more on cooking green vegetables, see chapter 12 on Plant Foods, page 3·258.

HISTORIC LAMB CURRIES

A culinary tour of regional Indian curries

Over the millennia, India has been a crossroad for many peoples. Some came to trade; some came to conquer. Some left a small footprint, whereas others left an almost indelible mark on Indian culture and cuisine. Foremost among the newcomers were the Mughals of Central Asia, the Portuguese, and the British.

Unsurprisingly, the cuisine of this large subcontinent varies considerably, influenced by climate, agricultural practices, and religion. Although curry can be found in most areas of India, the ingredients used and the method of preparation vary by region. This is evident in the regional preferences for spices, thickening agents, and even the texture and color of the curry.

Because Indian curries may number in the thousands—too numerous to document here—we have chosen five to showcase their enormous variety (see map on page 3·196). We begin with a northern Indian curry dating to the Mughals, then move to a curry from Hyderabad in the south, where Muslim cuisine prevails. Heading southwest to the Malabar Coast, we come to Goa, home of the fiery-hot vindaloo. Next, we travel south down the coast to Kerala, where Malayali curries feature coconut milk and black pepper. We finish on the southeastern coast in Chennai (formerly Madras), where Masala curry favors green chilies and mustard seeds.

Lamb shanks are the traditional backdrop for all of these curries, but other tough cuts of lamb, beef, or pork—as well as chicken or turkey—can also work, and many of the sauces here will complement fish or seafood. Use the sous vide time–temperatures tables on page 2·276 or the recipes in Cooking Meat and Seafood, page 3·70, as a guide. One of the advantages of cooking the meat sous vide and separately from the sauces is the ability to mix and match easily.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment*
OPTIONAL EQUIPMENT:	*centrifuge*
TIME REQUIRED:	*60 h overall, including 20–40 min of preparation and 1 h to reheat and finish*
SPECIAL CONSIDERATION:	*choose one curry, and prepare it with its traditional side dishes*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Sous Vide Lamb Shank see page 3·109	5 min	*60 h**	*30 min**	600 g (four shanks)
Tomato Puree see page 3·290	10 min	*25 min**	*1 h**	310 g
MUGHAL CURRY				
Mughal Curry Sauce	20 min	30 min and *12 h**	5 min	120 g
Apricots, pitted and thinly sliced				50 g
Cashew Halvah	5 min			40 g
GARNISH				
Indian sorrel leaves				30 g
MUSLIM CURRY				
Ghee see page 4·213	10 min	45 min	5 min	120 g
Muslim Curry Sauce	10 min	45 min	5 min	120 g
Candied Orange and Carrot Pulao	10 min	30 min	20 min	200 g

Red Rose Petals (organic or grown to be edible)				20 g
Rose Water				10 g
Dates, pitted and thinly sliced				20 g
Saffron Honey Foam		10 min	2 min	60 g
GARNISH				
Toasted pistachios				10 g
Toasted almonds				10 g
GOAN CURRY (VINDALOO, PORTUGUESE-STYLE)				
Goan Curry Sauce	10 min	1 h and *5 min**	5 min	120 g
Cucumber Black-eyed Pea Salad	10 min	30 min		60 g
Papadams (store-bought)			30 s	60 g
KERALA CURRY				
Kerala Curry Sauce	15 min	1 h	5 min	120 g
Green Papaya Pickle	10 min	12 min		40 g
Crispy Okra	7 min		3 min	50 g
Raw Okra	3 min		1 min	60 g
GARNISH				
Fenugreek leaves				30 g
Small mint leaves				20 g
MASALA CURRY (MADRAS)				
Masala Curry Sauce	10 min	1¼ h	5 min	120 g
Banana Yogurt	5 min	*12 min** and *1 h**	10 min	40 g
Tamarind Paste	8 min	*30 min**		60 g
Stuffed Smoky Braised Eggplant	25 min	45 min		200 g
GARNISH				
Toasted sesame seeds				20 g
Coriander leaves, small				20 g

**(unattended times)*

ASSEMBLY:

For Mughal Curry

Reheat lamb shanks in 58 °C / 136 °F bath for 1 h.

While lamb shanks are reheating:

Reheat curry sauce.

Arrange one lamb shank, apricot, and cashew halvah on each plate.

Finish with curry sauce.

Garnish with sorrel leaves.

For Muslim Curry

Reheat lamb shanks in 58 °C / 136 °F bath for 1 h.

While lamb shanks are reheating:

Cook pulao. Toast soaked rice in ghee for about 10 min. Add reserved carrots, candied orange, and measured water to rice. Bring to boil, reduce heat, and cook until tender and fluffy, about10 min.

While pulao is cooking:
Reheat curry sauce.
Arrange one lamb shank, dates, and rose petals on each plate.
Finish with curry sauce, pulao, rose water, and saffron honey foam.
Garnish with toasted pistachios and almonds.

For Goan Curry

Reheat lamb shanks in **58** °C / **136** °F bath for 1 h.
Heat frying oil to **195** °C / **385** °F.

While lamb shanks are reheating:
Reheat curry sauce.
Fry papadams until lightly golden and crispy, about 30 s. Transfer to paper towel-lined tray.
Toss cucumber-pea salad with seasoning blend.
Arrange one lamb shank and cucumber salad on each plate.
Finish with curry sauce and papadams.

For Kerala Curry

Reheat lamb shanks in **58** °C / **136** °F bath for 1 h.
Heat frying oil to **195** °C / **385** °F.

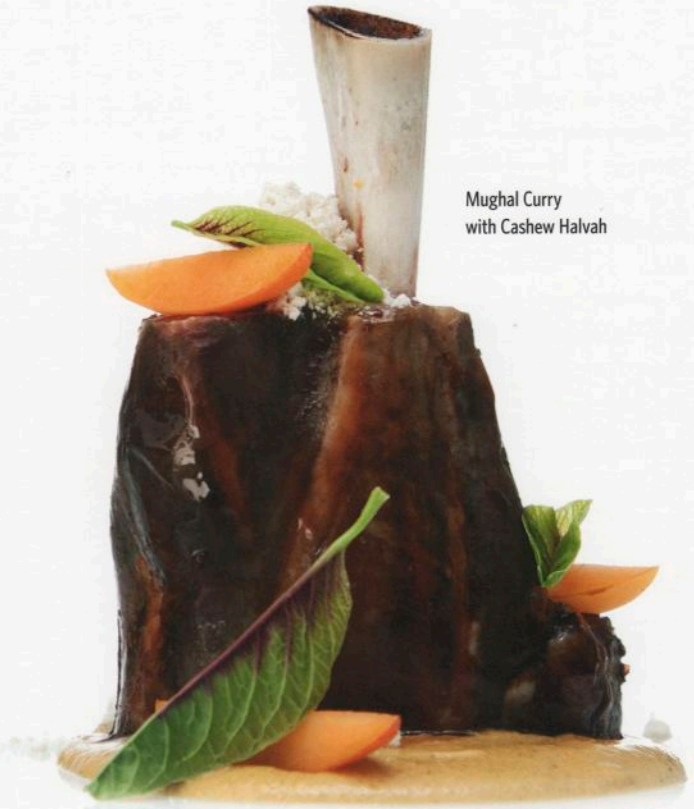
While lamb shanks are reheating:
Reheat curry sauce.
Coat okra in chickpea flour, and shake off excess.
Deep-fry okra until golden and crispy, about 3 min. Transfer to paper towel-lined tray.
Toss raw okra with onions and chaat masala, and season.
Arrange one lamb shank, crispy okra, raw okra, and papaya pickle on each plate.
Finish with curry base.
Garnish with fenugreek leaves and mint leaves.

For Masala Curry

Reheat lamb shanks in **58** °C / **136** °F bath for 1 h.

While lamb shanks are reheating:
Reheat curry sauce and braised eggplant.
Arrange one lamb shank, banana yogurt, and braised eggplant on each plate.
Finish with curry sauce.
Garnish with sesame seeds and coriander leaves.

Parathas are a delicious accompaniment to the Mughal curry. We make them nontraditionally with puff pastry dough (store-bought, or follow your favorite recipe). Roll two layers of the pastry on top of each other. Dust with thinly sliced green chilis, and panfry until golden and cooked through. Good quality store-bought parathas are also available at many Indian grocery stores.



Mughal Curry with Cashew Halvah

MUGHAL CURRY SAUCE

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Raw almonds	160 g	80%	① Cover with water, and soak in refrigerator for 12 h.
Raw cashews	160 g	80%	② Drain, and grind together to fine paste.
Poppy seeds	8 g	4%	③ Cover with water, and soak in refrigerator for 12 h.
			④ Drain, and grind to fine paste.
Shallots, thinly sliced	200 g	100%	⑤ Sauté shallots until translucent and lightly golden.
Ghee	30 g	15%	
Garlic, grated	6 g	3%	⑥ Combine aromatics, and add to shallots.
Ginger, grated	6 g	3%	⑦ Sauté together until golden, about 5 min.
Green Thai chili, finely minced	5 g	2.5%	
Turmeric (fresh), grated	4 g	2%	
Nutmeg, grated	2 g	1%	
Bay leaf	0.25 g	0.3%	
Mace blade	1.6 g	0.8%	⑧ Toast in 170 °C / 340 °F oven until golden and aromatic, 10–15 min.
Coriander seed	1 g	0.5%	
Cumin seed	0.5 g	0.25%	⑨ Grind to fine powder in coffee grinder or blender.
Cinnamon stick	0.5 g	0.25%	⑩ Add to sautéed mixture.
Black pepper	0.5 g	0.25%	
Clove	0.5 g	0.25%	
Green cardamom seeds	0.1 g	0.05%	
Raisins	25 g	12.5%	⑪ Add raisins to shallot-aromatics mixture, and add nut and poppy seed pastes.
			⑫ Simmer for 25 min, and remove from heat.
Plain yogurt	8 g	4%	⑬ Add to shallot mixture.
Lime juice	to taste		⑭ Season sauce.
Salt	to taste		⑮ Cool and refrigerate.

Instead of soaking the nuts and seeds for 12 h, you can soften them in a pressure cooker: 45 min at a gauge pressure of 1 bar / 15 psi.

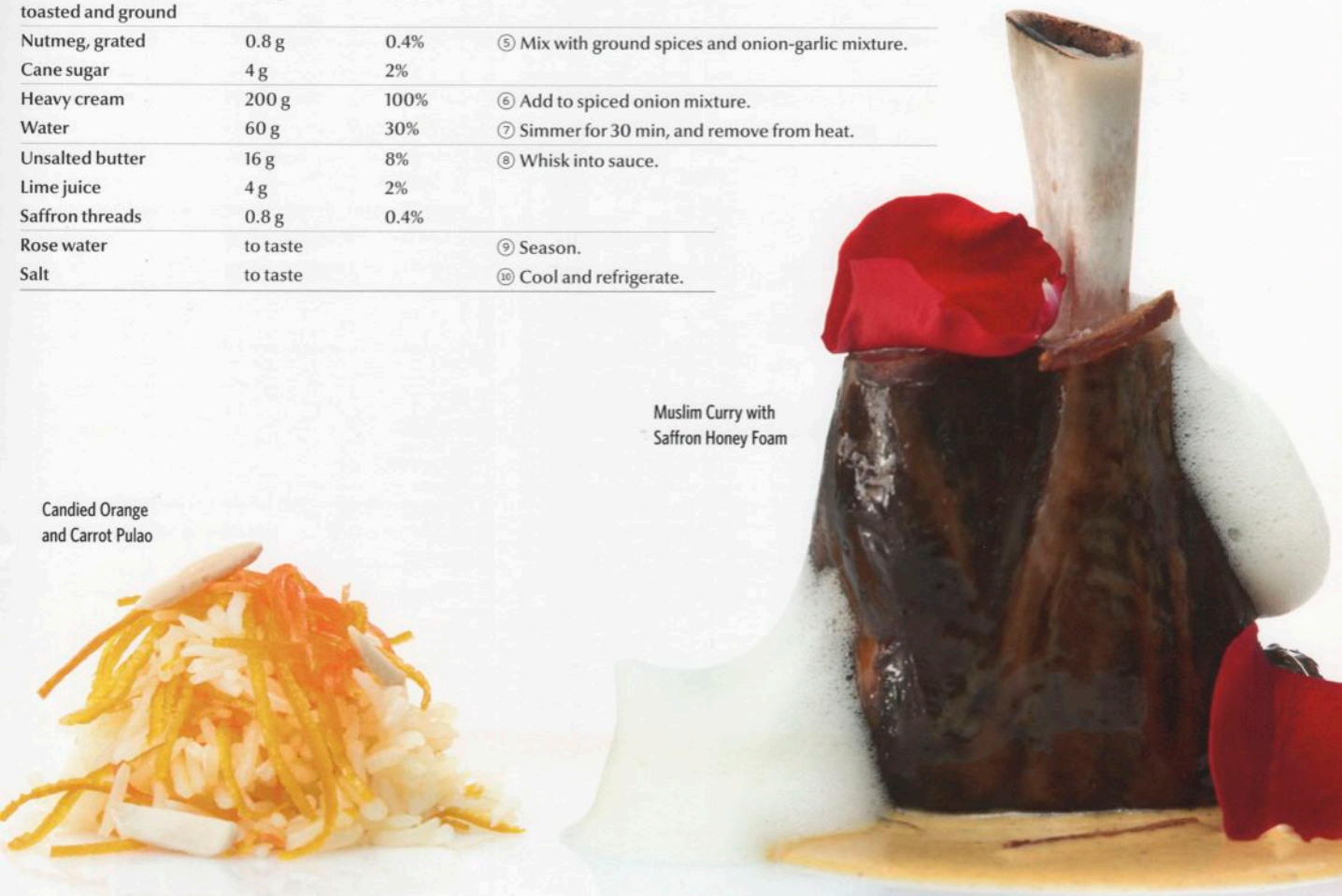
For more on making ghee, see page 4·213.

MUSLIM CURRY SAUCE

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ghee see page 4-213	40 g	20%	① Sauté until translucent and lightly golden, about 10 min.
Sweet onions, thinly sliced	110 g	55%	
Ginger, grated	7 g	3.5%	② Add to onion, and sauté until fragrant, about 5 min.
Garlic, grated	7 g	3.5%	
Black peppercorns, toasted and ground	2 g	1%	③ Toast in shallow pan in 170 °C / 340 °F oven until golden and aromatic, 10–15 min.
Green cardamom seeds, toasted and ground	2 g	1%	④ Grind to fine powder in coffee grinder or blender.
Cinnamon stick, toasted and ground	2 g	1%	
Cumin seeds, toasted and ground	2 g	1%	
Mace blade, toasted and ground	0.8 g	0.4%	
Nutmeg, grated	0.8 g	0.4%	⑤ Mix with ground spices and onion-garlic mixture.
Cane sugar	4 g	2%	
Heavy cream	200 g	100%	⑥ Add to spiced onion mixture.
Water	60 g	30%	⑦ Simmer for 30 min, and remove from heat.
Unsalted butter	16 g	8%	⑧ Whisk into sauce.
Lime juice	4 g	2%	
Saffron threads	0.8 g	0.4%	
Rose water	to taste		⑨ Season.
Salt	to taste		⑩ Cool and refrigerate.

These curry sauces have a traditional texture. They stick to the meat better if you add 0.2% xanthan gum, relative to the total weight of the sauce. Use a blender or rotor-stator homogenizer to blend the gum in after the final step in the recipe.



Muslim Curry with Saffron Honey Foam

Candied Orange and Carrot Pulao

CASHEW HALVAH

Yields 130 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cashews, roasted	100 g	100%	① Combine.
N-Zorbit M (National Starch brand)	30 g	30%	② Grind to fine powder.
Salt	1.5 g	1.5%	③ Refrigerate.

CANDIED ORANGE AND CARROT PULAO

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	300 g	100%	① Soak rice in salted water for 30 min.
Basmati rice	170 g	56%	② Drain and reserve.
Salt	2.5 g	0.8%	
Water	450 g	150%	③ Measure and reserve individually.
Ghee	35 g	11.7%	
Orange juice	90 g	30%	④ Combine, and simmer until syrupy, about 20 min.
Orange zest, fine julienne	45 g	15%	⑤ Reserve candied orange syrup.
Water	45 g	15%	
Sugar	25 g		
Carrots, fine julienne	70 g	23.3%	⑥ Cook carrots until tender.
Ghee	30 g	10%	⑦ Combine with candied orange syrup.
Almonds, toasted	10 g	3.3%	⑧ Measure and reserve individually.
Pistachios, toasted	10 g	3.3%	

SAFFRON HONEY FOAM

Yields 150 g

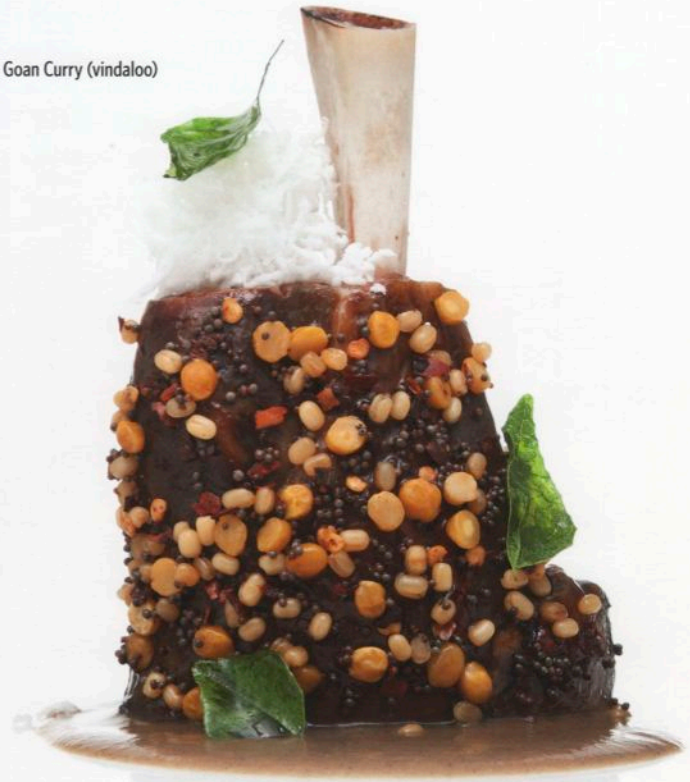
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	100 g	100%	① Combine.
Saffron threads	0.4 g	0.4%	② Infuse for 10 min at room temperature.
Honey	36 g	36%	③ Combine with saffron water.
Deoiled soy lecithin powder	1.4 g	1.4%	④ Blend until completely incorporated.
Whey protein isolate	0.2 g	0.2%	
Salt	to taste		⑤ Season, vacuum seal, and refrigerate.

CUCUMBER BLACK-EYED PEA SALAD

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Black-eyed peas	100 g	100%	① Cover with water, and soak in refrigerator for 8 h. ② Drain, and simmer until tender, about 25 min. ③ Drain, and cool completely.
Cucumber, peeled, seeded, cut into medium dice	170 g	170%	④ Combine with peas.
Coconut (fresh), thinly sliced	25 g	25%	
Green Thai chili, finely minced	2 g	2%	
Lemon juice	to taste		⑤ Season salad, and refrigerate.
Salt	to taste		
Coconut oil	15 g	15%	⑥ Heat oil in skillet.
Brown mustard seeds	2.3 g	2.3%	⑦ Add remaining ingredients, and toast until aromatic, about 5 min, to make seasoning blend.
Baby chickpea lentils (channa dal)	2 g	2%	⑧ Refrigerate.
Black gram (urad dal)	2 g	2%	
Cumin	1.8 g	1.8%	
Asafetida powder	0.8 g	0.8%	
Curry leaves	0.5 g	0.5%	
Dried red chili, crushed	0.3 g	0.3%	

Goan Curry (vindaloo)



Cucumber and Black-eyed Pea Salad

GOAN CURRY SAUCE

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	120 g	100%	① Sauté until translucent and lightly golden, about 10 min.
Ghee	35 g	29%	
Tomato puree see page 2-424	60 g	50%	② Add to onions. ③ Sauté mixture for 5 min.
Garlic, finely grated	7 g	5.8%	
Ginger, finely grated	7 g	5.8%	
Yellow mustard seeds	2 g	1.7%	④ Add to tomato-onion mixture, and sauté until fragrant, about 10 min.
Black peppercorns	5 g	4%	
Green cardamom seeds	4.2 g	3.5%	⑤ Toast in shallow pan in 170 °C / 340 °F oven until golden and aromatic, 10–15 min.
Turmeric, grated	4 g	3.3%	
Fennel seeds	3.4 g	2.8%	⑥ Grind to fine powder in coffee grinder or blender.
Coriander seeds	2.4 g	2%	
Cumin	2.4 g	2%	
Cane vinegar	40 g	33%	⑦ Combine with sauce.
Raw cane sugar	12 g	10%	⑧ Simmer for 45 min.
Bay leaf	0.5 g	0.4%	
Lime juice	to taste		⑨ Season sauce.
Salt	to taste		⑩ Cool and refrigerate.

The traditional way to toast spices in Indian cuisine is in a dry skillet. We prefer an oven for more control, but even with this method you need to watch that you don't burn your spices.

KERALA CURRY SAUCE

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shallots, finely minced	120 g	85%	① Sauté until shallots are translucent and golden, about 10 min.
Ghee	35 g	25%	
Green Thai chili	12 g	8.5%	
Garlic, finely grated	10 g	7%	② Add aromatics to shallot mixture, and sauté for 5 min.
Ginger, finely grated	10 g	7%	
Curry leaves	5 g	3.5%	
Bay leaf	0.5 g	0.4%	
Black peppercorns	14 g	10%	③ Mix thoroughly.
Cumin seeds	4 g	2.8%	④ Add to shallot-aromatics mixture, and sauté until fragrant, about 3 min.
Green cardamom seeds	3 g	2%	
Star anise	1.4 g	1%	⑤ Toast in shallow pan in 170 °C / 340 °F oven until golden and aromatic, 10–15 min.
Cinnamon stick	1 g	0.7%	
Whole cloves	1 g	0.7%	⑥ Grind to fine powder in coffee grinder or blender.
Coconut milk	140 g	100%	⑦ Add to shallot mixture, and simmer for 45 min.
Salt	to taste		⑧ Season sauce.
			⑨ Cool and refrigerate.

Kerala Curry with Crispy Okra and Green Papaya Pickle

Curries are by no means exclusive to India. Southeast Asia has its yellow, green, and red curries; there are adaptations from Iran to Britain to Japan. But they all share the basics: meat, seafood, or just loads of flavorful vegetables in a fragrant, spicy sauce, usually served with rice.

GREEN PAPAYA PICKLE

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Papaya (semiripe), peeled	225 g	90%	① Julienne and reserve.
Cane vinegar	250 g	100%	② Reserve 150 g of vinegar.
Red onions, finely minced	75 g	30%	③ Combine 100 g of vinegar with remaining ingredients, and grind to coarse paste.
Black mustard seeds	25 g	10%	
Garlic, finely minced	8 g	3%	
Ginger, finely minced	8 g	3%	
Bird's eye chili, finely minced	1.5 g	0.50%	
Neutral oil	20 g	8%	④ Fry paste over medium heat, stirring constantly, until aromatic but not colored, about 10 min.
Sugar	40 g	16%	⑤ Add to cooked paste with reserved 150 g of vinegar.
Green chili pepper, minced	5 g	2%	⑥ Fold julienned papaya into warm paste.
			⑦ Simmer for 2 min.
Salt	5 g	2%	⑧ Cool completely, vacuum seal, and refrigerate.
Turmeric (fresh), grated	4.5 g	1.8%	

CRISPY OKRA

Yields 120 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Okra, cut in half lengthwise	100 g	100%	① Combine, and let marinate for 5 min.
			② Strain and refrigerate.
Lime juice	2 g	2%	
Salt	2 g	2%	
Chili powder	1 g	1%	
Chickpea flour	35 g	35%	③ Measure and reserve individually.
Frying oil	as needed		

RAW OKRA

Yields 80 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Okra, sliced into thin rounds	50 g	100%	① Arrange on paper towel–lined tray, and refrigerate.
Red onion, finely minced	20 g	40%	② Measure and reserve individually.
Chaat masala see next page	2 g	4%	
Salt	to taste		

MASALA CURRY SAUCE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	200 g	80%	① Sauté onions until translucent and amber, about 25 min.
Ghee	30 g	12%	
Tomato puree see page 2-424	250 g	100%	② Add to onions, and sauté for 1 min.
Curry leaves	2.5 g	1%	③ Reserve warm.
Coconut (fresh), grated	60 g	24%	④ Grind together to fine paste.
Garlic, finely grated	10 g	4%	⑤ Add to tomato-onion mixture, and sauté for 3 min.
Ginger, finely grated	10 g	4%	⑥ Reserve warm.
Dried bird's eye chili, crushed	3.5 g	1.4%	
Fenugreek seeds	2.4 g	1%	⑦ Toast in shallow pan in 170 °C / 340 °F oven until golden and aromatic, 10–15 min.
Coriander seeds	2 g	0.8%	
Fennel seeds	2 g	0.8%	⑧ Grind to fine powder in coffee grinder or blender.
			⑨ Stir into tomato-onion mixture.
			⑩ Sauté until aromatic.
Water	160 g	64%	⑪ Add to tomato-onion mixture.
Tamarind paste see next page	60 g	24%	⑫ Simmer for 45 min.
Turmeric (fresh), grated	9 g	3.6%	
Lime juice	to taste		⑬ Season sauce.
Salt	to taste		⑭ Cool and refrigerate.

BANANA YOGURT

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Bananas, unpeeled	500 g	500%	① Cook sous vide in 88 °C / 190 °F bath for 12 min.
			② Peel, puree, and measure 100 g.
			③ Centrifuge 400 g of puree at 27,500*g* for 1 h.
			④ Decant juice, and reserve 40g.
Banana puree, from above	100 g	100%	⑤ Puree until smooth.
Banana juice, from above	40 g	40%	
Crème fraîche	30 g	30%	
Salt	to taste		⑥ Season yogurt.
			⑦ Refrigerate.

Masala (Madras) Curry

TAMARIND PASTE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tamarind, pulp with seeds and fibers	350 g	100%	① Vacuum seal together.
Water	125 g	36%	② Cook sous vide in 80 °C / 170 °F bath for 30 min. ③ Press through fine sieve to form fine paste, and reserve.

STUFFED SMOKY BRAISED EGGPLANT

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cumin seeds	5 g	1.25%	① Combine, and toast in 170 °C / 340 °F oven until golden and aromatic, 10–15 min.
Coriander seeds	4 g	1%	
Black peppercorns	3.5 g	0.9%	② Grind to fine powder.
Fennel seeds	2 g	0.5%	
Chili powder	0.5 g	0.13%	
Toasted peanuts	100 g	25%	③ Combine, and toast in shallow pan in 170 °C / 340 °F oven for 10–15 min or until golden and aromatic.
Toasted dried coconut	30 g	7.5%	④ Grind to coarse powder.
Cane vinegar	20 g	5%	⑤ Add spice powder, coconut-peanut powder, and remaining ingredients to ghee.
Raw cane sugar	16 g	4%	
Ghee	15 g	3.75%	
Lime juice	8 g	2%	
Curry leaves	5 g	1.25%	
Black onion seeds	2 g	0.5%	
Salt	to taste		⑥ Season sauce. ⑦ Refrigerate until needed.
Tomatoes, blanched, peeled, and seeded	250 g	62.5%	⑧ Puree, and strain through fine sieve.
Tamarind paste, from above	60 g	15%	⑨ Combine with tomato puree. ⑩ Bring to boil, and simmer for 45 min to make eggplant stuffing.
Water	50 g	12.5%	
Garlic, mashed	5 g	1.25%	
Ginger, juice	5 g	1.25%	
Salt	to taste		⑪ Season stuffing. ⑫ Cool and refrigerate.
Indian eggplants	400 g four small	100%	⑬ Cut lid from stem end of each eggplant. ⑭ Remove flesh, leaving wall of flesh and skin, 0.5 cm / ¼ in thick. ⑮ Fill hollowed eggplants with stuffing, and cover with stem-end lid. ⑯ Place stuffed eggplants upright on sauce base, and simmer, basting frequently until tender, about 30 min. ⑰ Cool and refrigerate.

SUNDAY PORK BELLY

Applesauce terrine, crispy corn pudding, red wine cabbage, red-eye gravy

In this Modernist interpretation of a classic dish, a block of gelled applesauce is grilled, caramelizing the sugars. Corn pudding is fried like a New Orleans beignet.

The brine for the pork belly includes curing nitrites that heighten flavor and prevent the myoglobin in the meat from oxidizing and turning the pork gray as it cooks. The result is similar to unsmoked bacon. You can also prepare the recipe with a plain salt brine, or without any brine for interesting variations, which some people prefer to the cured, ham-like flavors of brined pork.

Red-eye gravy, also known as "poor man's gravy," gets a subtle update. It's made from panfried ham drippings, and the pan deglazed with coffee; maple syrup adds a distinctive flavor imported from the North. And salt makes it a little less bitter. That's right: salt masks bitterness better than sugar. Scientists are not sure whether salt neutralizes taste receptors or signals a change to the brain, but the effect is pronounced and helps balance the flavor of this gravy.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, juicer, pressure cooker*
OPTIONAL EQUIPMENT:	*freeze dryer*
TIME REQUIRED:	*8½ d overall, including 1½ h preparation, and 25 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Freeze-dried Corn **optional, see page 3·372**	5 min	*36 h**		
Pink Brine **see page 3·168**	3 min			480 g
Sous Vide Pork Belly	5 min	*5 d** and *40 h**	20 min	600 g
Brown Pork Stock **see page 2·296**	15 min	*3 h**		500 g
Red-eye Gravy	15 min	1 h	5 min	70 g
Hot Applesauce Terrine	15 min	*2 h**	5 min	
Crispy Corn Pudding	10 min	45 min and *4 h**	10 min	160 g (eight pieces, 20 g each)
Red Wine Cabbage	10 min	20 min	2 min	300 g
GARNISH				
Green apple, thin slices				12
Small mustard leaves				12

**(unattended times)*

ASSEMBLY:

Reheat pork belly portions in **62** °C / **144** °F bath, about 15 min.
Preheat frying oil for corn pudding to **190** °C / **375** °F.

While pork belly is reheating:

Sear pork belly portions, fat side only, until golden, about 2 min.
Deep-fry corn pudding until golden, about 1 min. Drain on paper towels.
Cut applesauce terrine into cubes.
Brush terrine cubes with clarified butter. Warm in a **70** °C / **158** °F oven for 5 min.
Warm in a **70** °C / **158** °F oven for 5 min.
Warm cabbage, and fold in remaining ingredients.
Bring gravy to simmer, and taste for seasoning.
Arrange one portion of pork belly on each plate.
Garnish with one spoonful of cabbage, two pieces of crispy corn pudding, one piece of apple terrine, and green apple slices and mustard leaves.
Spoon gravy over meat at table.

SOUS VIDE PORK BELLY

Yields 1.6 kg

We use a pink brine to slightly cure the pork belly. The recipe is also excellent with a simple salt brine, however, and you can even omit the step altogether. Uncured meat will not stay pink and will taste quite different than cured meat, but it is still very good. For more on brining strategies, see page 3-168.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole pork belly, on bone	2.4 kg	100%	① Inject brine equal to 10% of pork belly weight.
Pink brine see page 3-173	480 g	10%	② Vacuum seal in remaining brine for 3 d. ③ Drain brine from bag, and reseal pork belly. ④ Refrigerate for 2 d before cooking to diffuse salt through meat. ⑤ Remove meat from bag, and drain.
Water	800 g	33%	⑥ Vacuum seal pork belly with water. ⑦ Cook sous vide in 62 °C / 144 °F bath for 40 h. ⑧ Chill in ice-water bath until firm. ⑨ Remove belly from bag, and discard gelled cooking juices. ⑩ Carve belly from ribs, and remove skin. Discard bones and skin. ⑪ Portion belly into square blocks of 150 g each. ⑫ Vacuum seal each portion individually. ⑬ Refrigerate.
Frying oil	as needed		⑭ Reserve.

RED-EYE GRAVY

Yields 75 g

For more on rendering fat, see page 3-145.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	80 g	16%	① Sauté onions until golden and tender, about 15 min.
Rendered pork fat	30 g	6%	
Star anise	0.2 g	0.04%	② Add to onions. ③ Continue cooking over lower heat until onions are dark amber and star anise is fragrant.
Brown pork stock see page 2-296	500 g	100%	④ Deglaze. ⑤ Reduce to 75 g, and remove gravy from heat.
Maple syrup (grade B)	15 g	3%	
Coffee beans	25 g	5%	⑥ Add to gravy, and cover. ⑦ Infuse for 5 min. ⑧ Strain, discarding coffee beans.
Microcrystalline cellulose (Avicel CC-200, FMC Biopolymer brand)	0.2 g	0.04% *(0.27%)**	⑨ Blend into gravy to thicken.
Smoked salt	to taste		⑩ Season, and refrigerate.

(% of total weight after reduction)

HOT APPLESAUCE TERRINE

Yields 600 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ambrosia apples, peeled and cored	200 g	100%	① Vacuum seal. ② Cook sous vide in 85 °C / 185 °F bath for 2 h. ③ Puree until smooth, and reserve.
Honeycrisp apple juice, clarified	350 g (from 700 g apples)	175%	④ Reduce to 200 g, and cool.
Reduced apple juice, from above	200 g	100%	⑤ Disperse agar, locust bean gum, and sorbitol into cooled juice reduction.
Sorbitol	12 g	6% *(3%)**	
Agar	2.4 g	1.2% *(0.6%)**	
Locust bean gum (Tic Gums brand)	1 g	0.5% *(0.25%)**	
Spray-dried apple crystals,optional, (Obipektin brand)	40 g	20%	⑥ Blend reduction mixture with cooked apple to fine puree. ⑦ Pass through fine sieve.
Fructose	15 g	7.5%	⑧ Heat mixture to 95 °C / 203 °F, and hold at 3 min to fully hydrate.
Malic acid	8 g	4%	⑨ Cast in mold in layer 1 cm / ⅜ in thick. ⑩ Refrigerate until set, about 20 min.
Clarified unsalted butter	as needed		⑪ Refrigerate.

**(% of total weight of apple puree and reduced apple juice)*

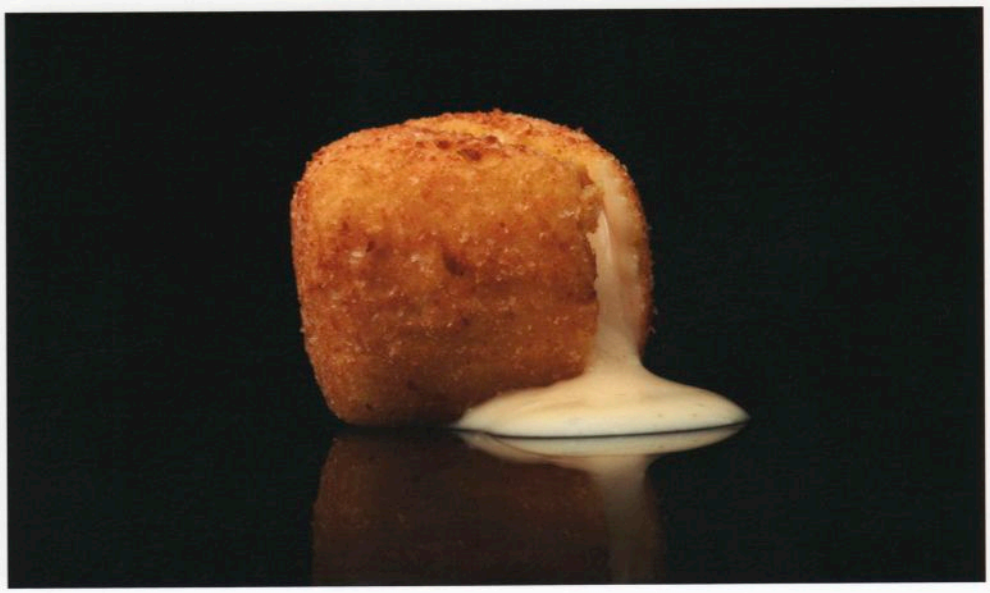
For more on clarifying butter, see page 4·213.

CRISPY CORN PUDDING

Yields 780 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
For the popcorn puree:			
Whole milk	800 g	355%	① Bring to a boil, and remove from heat.
Popped corn	140 g	62%	② Cover, and steep corn for 30 min.
			③ Puree.
			④ Pass through fine sieve.
			⑤ Cool.
			⑥ Measure 350 g of popcorn puree.
For the corn pudding:			
Frozen white corn, thawed	225 g	100%	⑦ Sauté until lightly golden.
Unsalted butter	20 g	9%	⑧ Cool.
Popcorn puree, cold, from above	350 g	155%	⑨ Disperse gelatin in popcorn puree.
			⑩ Bring to a simmer to dissolve.
160 Bloom gelatin	20 g	9% (*5.7%*)*	⑪ Remove from heat, and cool.
Heavy cream	100 g	44.5%	⑫ Blend until smooth with sautéed white corn and gelled puree.
Egg yolks	36 g	16%	
Maple syrup (grade B)	34 g	15%	⑬ Pass through fine sieve.
Salt	7 g	3%	⑭ Cast in mold in layer 2.5 cm / 1 in thick.
Cayenne pepper	3 g	1.5%	⑮ Refrigerate until set, at least 4 h.
Thyme essential oil	0.01 g	0.004%	⑯ Cut into cubes.
For the corn pudding crust:			
Freeze-dried corn see page 3·366	200 g	89%	⑰ Combine to make breading, and reserve.
Panko	200 g	89%	
All-purpose bleached flour	100 g	44.5%	⑱ Combine.
Ultra-Crisp (National Starch brand)	50 g	22%	⑲ Dredge corn cubes in starch blend until evenly coated.
Eggs, whisked	125 g	56%	⑳ Dip cubes in eggs, and finish by coating with reserved breading. Refrigerate.
Frying oil	as needed		㉑ Reserve.

(% of weight of popcorn puree*)



Crispy corn pudding hides its own sauce on the inside.

RED WINE CABBAGE

Yields 375 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Red cabbage leaves	100 g	100%	① Vacuum seal. ② Blanch sous vide in 90 °C / 194 °F bath for 4 min. ③ Cool in ice-water bath, and remove from bag immediately. ④ Trim off and discard larger ribs; julienne leaves finely. ⑤ Reserve.
Red wine (dry)	200 g	200%	⑥ Combine, and reduce to 200 g.
Red cabbage juice	180 g (from about 300 g cabbage)	180%	⑦ Add julienned cabbage leaves, and finish cooking through, about 1 min.
Pineapple juice (fresh)	65 g (from about 100 g pineapple)	65%	
Red wine vinegar	50 g	50%	
Red onion juice	40 g (from 100 g onions)	40%	
Lime juice	1.2 g	1.2%	⑧ Season cabbage mixture, and reserve.
Salt	to taste		
Unsalted butter	40 g	40%	⑨ Measure and reserve individually.
Pineapple, small dice	35 g	35%	
Coriander seeds, toasted and coarsely crushed	2 g	2%	
Lime zest, finely grated	0.5 g	0.5%	

For more on juicing strategies, see page 2·338.

The silkie chicken has feathers as white as snow, but its skin and feet are pitch black.

POULTRY

FOIE GRAS À LA VAPEUR

INSPIRED BY ALAIN SENDERENS

Napa cabbage, green walnuts, Muscat grapes, and vanilla

In its day, L'Archestrate may have been the most controversial three-star restaurant in Paris. Critics in the early 1980s insisted that chef Alain Senderens's cuisine was too Chinese, too fussy, too unfamiliar. Simply put, L'Archestrate was a revolutionary restaurant. One oft-copied dish Senderens pioneered was steamed foie gras wrapped in Savoy cabbage. The cabbage acted as a natural sous vide bag for the foie gras, ensuring that it cooked evenly in a moist environment at a relatively low temperature.

Chef Senderens played an integral role in popularizing the highly subjective art of pairing wine with food: *le mariage des vins et des mets*. In his own words, the unctuous foie gras should be matched with an intense, sweet, and aromatic wine to balance the richness of the dish. An acidic, mineral wine accentuates the bitterness of the liver. In this recipe, we season the duck broth with a dry white port, vanilla, and fresh bay laurel to evoke the sweetness and complexity of a Sauternes without actually introducing any sugar.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, pressure cooker, blowtorch*
OPTIONAL EQUIPMENT: *centrifuge*
TIME REQUIRED: *4½ h overall, including 1 h preparation and 40 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
White Duck Stock see page 2·301	20 min	*1½ h**		200 g
Sous Vide Foie Gras	2 min		*35 min**	400 g
Duck Broth with Vanilla and Bay Leaf	10 min	*2 h**	1 min	120 g
Compressed Muscat Grapes	10 min	1 min		80 g
Braised Napa Cabbage	5 min		3 min	120 g
Spiced Walnut Vinegar Gel	2 min	10 min		40 g
GARNISH				
Green walnuts, shaved				50 g
Sichuan peppercorns, crushed				8 g

*(unattended times)

ASSEMBLY:

Cook foie gras sous vide directly from freezer in **53** °C / **127** °F bath to core temperature of **52** °C / **126** °F, about 35 min.

While foie gras is cooking:

Warm duck broth, and check seasoning.
Sauté cabbage in foie gras fat, and season.
Sear cooked foie gras portions with blowtorch.
Cut each portion into slices 1 cm / ⅜ in thick.
Arrange cabbage in middle of each plate, and place foie gras slices on top.
Garnish with compressed grapes, shaved walnuts, and Sichuan peppercorns.
Grate walnut vinegar gel over foie gras.
Pour broth at table.

SOUS VIDE FOIE GRAS

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Flash-frozen foie gras, presliced, 2.5 cm / 1 in	400 g (four 100 g portions)	100%	① Vacuum seal portions individually. ② Reserve in freezer until needed.

For more on the science of foie gras, see page 3·136. For other methods of hot foie gras preparation, see page 3·146.

DUCK BROTH WITH VANILLA AND BAY LEAF

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Duck meat, finely ground	400 g	400%	① Brown together lightly in pressure cooker, about 10 min.
Duck wings, chopped	100 g	100%	
Duck fat	30 g	30%	
Shallots, thinly sliced	125 g	125%	② Add to duck parts, and cook until translucent.
Leeks, thinly sliced	75 g	75%	
White port (dry)	150 g	150%	③ Add to duck parts, and reduce to 225 g.
White wine	150 g	150%	
Water	700 g	700%	④ Add to pressure cooker, and pressure-cook at a gauge pressure of 1 bar / 15 psi for 1½ h.
Vanilla bean seeds	1.5 g	1.5%	
Bay leaf	0.5 g	0.5%	⑤ Strain through fine sieve.
Lime juice	to taste		⑥ Season broth.
Salt	to taste		⑦ Refrigerate.

We do not recommend venting the pressure cooker for this recipe. Although the stock will cook at a lower temperature, venting evaporates many volatile aromas that are needed for a balanced flavor, as discussed further on page 2·291.

COMPRESSED MUSCAT GRAPES

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Muscat grapes	100 g	100%	① Blanch in boiling water for 20–45 s. Riper grapes require less time. ② Shock in ice-water bath, then peel and reserve.
Grape juice, clarified	100 g	100%	③ Mix together.
Verjuice (store-bought)	60 g	60%	④ Taste for seasoning balance.
Fructose	12 g	12%	⑤ Vacuum seal with peeled grapes to compress.
Malic acid	1.3 g	1.3%	⑥ Refrigerate.
Salt	to taste		

For more on juice clarification strategies, see page 2·351.

BRAISED NAPA CABBAGE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Napa cabbage, ribs removed and julienne	250 g	100%	① Measure and reserve individually for service.
Rendered foie gras fat	25 g	10%	
Salt	to taste		

For more on strategies for rendering fat, see page 3·145.

SPICED WALNUT VINEGAR GEL

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White duck stock, cold see page 2·301	200 g	100%	① Disperse agar in stock.
Agar	6 g	3%	
Salt	6 g	3%	② Whisk into stock mixture until dissolved.
Ascorbic acid (vitamin C)	1 g	0.5%	
Sugar	1 g	0.5%	
Black peppercorns, toasted and cracked	3 g	1.5%	③ Add to stock mixture.
			④ Boil for 3 min to hydrate agar.
Coriander seeds, toasted and crushed	2 g	1%	⑤ Strain thorough fine sieve directly into hemisphere nonstick mold.
Sichuan peppercorns, toasted and crushed	1.5 g	0.75%	⑥ Refrigerate until set.

CRISPY HAY-SMOKED CHICKEN

Pickled ramps, fiddleheads, sticky rice, vin jaune

Smoking is a wonderful way to prepare food, but it has a real drawback when used with chicken. Compounds in the smoke act on the skin and effectively tan it to a tough, leathery consistency. It may look beautiful, but often it isn't very good to eat. Here we combat that problem in two ways. First, we do a very light application of smoke, by using hay, which burns so quickly that it perfumes the bird with a very light, smoky aroma but doesn't cook the chicken in the process. Our second—and more important—trick is to prepare the skin separately to be incredibly crisp, then to affix it back on the bird by using Activa. The chicken is slow-roasted, then bathed in liquid nitrogen, and finally deep-fried to crisp the skin without overcooking the meat. Although this dish may seem the least Modernist in appearance of all those in this book, the recipe employs several Modernist tricks behind the scenes to get a result that you'd be hard-pressed to achieve other ways. For simpler ways to make a crisp roast chicken, see pages 2·109 and 2·178.

YIELD: *four portions*
SPECIAL EQUIPMENT: *gas blowtorch, pressure cooker, sous vide equipment*
OPTIONAL EQUIPMENT: *combi oven, Pacojet, liquid nitrogen*
TIME REQUIRED: *16 h overall, including 5 h preparation and 1 h to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Ultracrisp Skin see page 3·134	1½ h	*14 h**		280 g
Foie Gras Parfait see page 267	30 min and *5 h**	20 min and *3 h**		100 g
Hay-Smoked Chicken Crown	10 min	*12 h** and 30 min		1 kg
Pickled Ramps	10 min	*12 h**		80 g
Steamed Sticky Rice	5 min	*12 h**	*35 min**	160 g
Crisp Chicken Crown	15 min	*5½ h**	*1 h 40 min** and 10 min	500 g (carved)
Sauce Vin Jaune	15 min	*2 h**	3 min	140 g
Brown Chicken Stock see page 2·296	1 h	*1½ h**		650 g
White Chicken Stock see page 2·301	20 min	*1½ h**		100 g
Stuffed Morels	1 h		8 min	250 g
Stir-fried Fiddlehead Ferns	10 min		3 min	125 g

**(unattended times)*

ASSEMBLY:

Cook chicken crown in combi oven at 0% humidity and **65** °C / **150** °F until core temperature reaches **60** °C / **140** °F, about 2 h depending on the size of the chicken. If using a CVap oven, set the Browning level to 4 and Doneness as above.

Lower temperature to **60** °C / **140** °F, and hold for 1 h.

Heat peanut oil for frying crown to **200** °C / **390** °F.

Drain pickled ramps, and slice into quarters.

While chicken is in oven:

Steam sticky rice for 30 min. Allow to rest, uncovered, for 5 min.

Warm coconut milk mixture, and fold into cooked rice.

While rice is cooking:

Brush stuffed morels with butter.

Cook in frying pan over medium-low heat for about 8 min. Roll morels over gently every 2 min to ensure even cooking. Season.

Cryosear chicken crown by dipping in liquid nitrogen for 45 s, preferably with wire hook (see page 3·134).

Deep-fry in hot oil for 45 s. Repeat process until golden and very crisp, about three cycles.

Warm sauce vin jaune, and verify seasoning.

Stir-fry fiddleheads in very hot oil for 2 min, moving them constantly to ensure blistering without burning. Douse with stock or water, a little at a time, until cooked through. Add garnishes and continue stir-frying for 20 s. Season with salt and pepper. Arrange fiddleheads on each plate.

Slice breasts from crown, and cut into slices 1 cm / ⅜ in thick. Arrange on top of fiddleheads.

Garnish with morels and pickled ramps.

Serve sauce vin jaune and steamed sticky rice on side.

HAY-SMOKED CHICKEN CROWN

Yields 1 kg

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole chicken	1 kg	100%	① Remove legs and wings. ② Cut through ribs to remove bone-in crown, and reserve crown. ③ Reserve carcass, legs, and wings for sauce vin jaune.
Water	400 g	40%	④ Combine to make brine.
Salt	28 g	2.8%	⑤ Immerse crown in brine.
Thyme	2 g	0.2%	⑥ Refrigerate for 12 h. ⑦ Drain, and rinse crown.
Yellow sweet meadow hay or straw	100 g	10%	⑧ Lay hay in bottom of hotel pan. ⑨ Place crown in center of hay, and cover with more hay. ⑩ Ignite hay with blowtorch until burning. ⑪ Cover with another pan, and let smolder for 10 min. ⑫ Remove crown from hay, and cool completely. ⑬ Peel away skin, and discard. ⑭ Refrigerate smoked crown.

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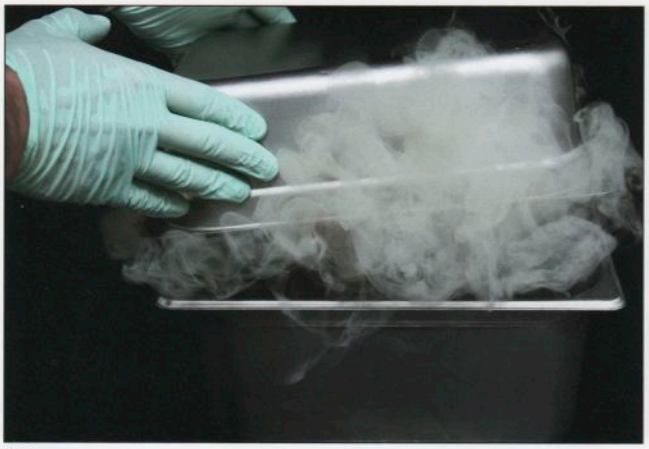

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CRISP CHICKEN CROWN

Yields 1.25 kg

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ultracrisp skin see page 3-134	280 g	28%	① Dust Activa evenly over skin.
Activa RM or GS	3 g	0.3%	
Hay-smoked chicken crown, from above (or unsmoked chicken crown)	1 kg	100%	② Place skin over chicken crown, and tuck in all edges. ③ Vacuum seal, and leave at room temperature for 30 min to ensure all air pockets between skin and meat are removed. ④ Remove from bag, and refrigerate for at least 5 h before serving to ensure Activa enzyme has bonded and skin is dry.
Liquid nitrogen	as needed		⑤ Reserve individually for use during assembly.
Frying oil	as needed		

SAUCE VIN JAUNE

Yields 200 g

INGREDIENT	QUANTITY	SCALING*	PROCEDURE
Chicken legs and wings, from above, cut into 3 cm / 1¼ in pieces	400 g	200%	① Sauté in pressure cooker until golden. ② Drain wings, and reserve.
Clarified unsalted butter	75 g	37.5%	
Leeks, white part only, thinly sliced	100 g	50%	③ Cook together until vegetables are tender, about 30 min.
Carrot, peeled and thinly sliced	50 g	25%	
Chicken carcass, from above, chopped and blanched	50 g	25%	
Shallot, thinly sliced	50 g	25%	
Brown chicken stock see page 2-296	450 g	225%	④ Combine with browned wings and cooked vegetables in pressure cooker.
Thyme	5 g	2.5%	⑤ Cook at a gauge pressure of 1 bar / 15 psi for 1½ h.
Bay leaf	2 g	1%	⑥ Cool. ⑦ Strain stock through fine sieve, and set aside.
Vin jaune du Jura (or Fino sherry)	120 g	60%	⑧ Reduce to 30 g, about 12 min. ⑨ Add strained stock. ⑩ Reduce mixture to 200 g. ⑪ Cool.
Chicken stock reduction, from above	200 g	100%	⑫ Disperse PGA into stock reduction. ⑬ Bring to simmer to fully hydrate.
Propylene glycol alginate (Protanal Ester BV4830, FMC BioPolymer brand)	0.4 g	0.2%	⑭ Blend fat into stock reduction until fully emulsified.
Rendered chicken fat	40 g	20%	
Lemon juice	to taste		⑮ Season, cool, and refrigerate.
Salt	to taste		

(% of total weight of stock reduction)

For more on strategies for rendering fat, see page 3-145.

STUFFED MORELS

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	100 g	100%	① Bring water to a boil, and pour over morels.
Morels (dried)	20 g	20%	② Soak at room temperature for 30 min to hydrate.
			③ Squeeze dry, reserving released water.
			④ Strain soaking water, and reserve.
			⑤ Mince morels finely, and reserve.
Brown chicken stock see page 2-296	200 g	400%	⑥ Combine with soaking water from above.
			⑦ Reduce to 40 g to create glaze, about 15 min.
Fino sherry	150 g	150%	
White port (dry)	100 g	100%	
Heavy cream	20 g	20%	
Lime juice	to taste		⑧ Season glaze.
Salt	to taste		
Foie gras parfait see page 267	100 g	100%	⑨ Blend until smooth.
			⑩ Fold in seasoned glaze and reserved, hydrated morels.
Egg whites	30 g	30%	
Thyme	0.5 g	0.5%	⑪ Transfer mixture to piping bag.
Morels (fresh)	100 g	100%	⑫ Stuff with morel mixture.
			⑬ Refrigerate.
Clarified unsalted butter see page 4-213	as needed		⑭ Reserve individually.
Salt	to taste		

PICKLED RAMPS

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	200 g	100%	① Combine and bring to a simmer.
White wine vinegar	200 g	100%	
Sugar	80 g	40%	
Salt	12 g	6%	
Yellow mustard seeds	3 g	1.5%	
Black peppercorns	2.5 g	1.25%	
Coriander seeds	1.5 g	0.75%	
Bay leaf	0.5 g	0.25%	
Ramp bulbs, cleaned	450 g	225%	② Pour warm brine over bulbs.
			③ Cool mixture.
			④ Vacuum seal.
			⑤ Refrigerate for at least 12 h.

Ramps are available for only a short time in the spring. Other young tender alliums, such as baby leeks, spring onions, pearl onions, or green onions, make good substitutes.

STIR-FRIED FIDDLEHEAD FERNS

Yields 155 g

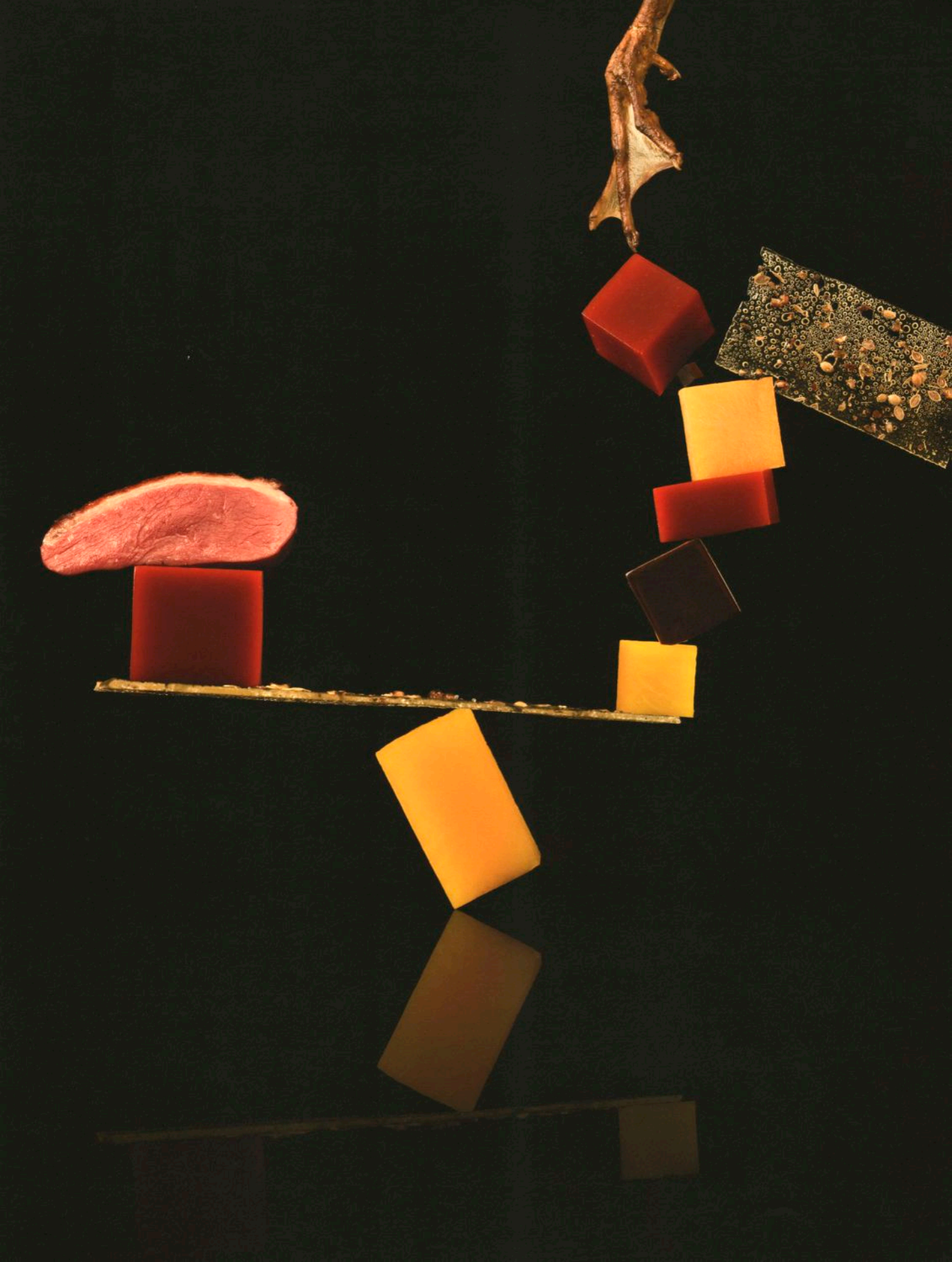
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Fiddlehead ferns	120 g	100%	① Measure and reserve individually.
White chicken stock or water see page 2·301	40 g	33%	
Alsatian bacon, small dice	20 g	16.7%	
Frying oil	20 g	16.7%	
Scallions, fine julienne	10 g	8.3%	
Garlic, germ removed and finely minced	6 g	5%	
Black peppercorns, coarsely ground	2.5 g	2%	
Salt	to taste		

As with ramps, the availability of fiddlehead ferns is extremely seasonal. Asparagus, green beans, and wax beans are just as delicious in this recipe.

STEAMED STICKY RICE

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White chicken stock or water see page 2·301	60 g	100%	① Hand-blend. ② Refrigerate.
Coconut milk	40 g	67%	
Clarified unsalted butter, warmed	12 g	20%	
Salt	2 g	3.5%	
Water	480 g	800%	③ Combine.
Sticky rice	60 g	100%	④ Soak rice in refrigerator for 12 h. ⑤ Drain. ⑥ Spread rice on cheesecloth-lined perforated tray. ⑦ Refrigerate.



DUCK APICIUS

Quince jelly, spiced honey glass, saffron turnip, pomegranate jus

Duck Apicius pays homage to the French chef Alain Senderens who, in turn, took inspiration for his famous Canard Apicius from *De re coquinaria*, named for the 4th-century Roman gourmet Apicius (see page 1·10). The duck here is accompanied by a jus combining pomegranate and *garum* (fish sauce). In Roman times, this condiment of choice was a savory liquid containing myriad taste-enhancing amino acids and umami compounds.

It came in a variety of forms, some more expensive than others. *Garum*, made by fermenting salted mackerel and filtering the resulting liquid, was favored by the rich. Tuna yielded *muria*, a similar concoction for the slightly less wealthy. *Liquamen* was the poor man's sauce, made from the blood and guts of whatever fish people happened to be throwing away. The pungent aromas and savory tastes of *bagoong* from the Philippines and *nam pla* from Thailand make them the closest modern kin to *garum*. Either of them can be used in its place in this recipe.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*refractometer, pH meter, pressure cooker, sous vide equipment*
OPTIONAL EQUIPMENT:	*Thermomix*
TIME REQUIRED:	*6 h overall, including 3 h preparation and 30 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Brown Duck Stock see page 2·296	30 min	*1½ h**	3 min	200 g
Pomegranate and Garum Jus	15 min	3 min	15 min	120 g
Date Puree	10 min	*2 h**		100 g
Quince Jelly see page 4·167	10 min	*1½ h**	5 min	100 g
Spiced Honey Glass	30 min	7 min		four rectangles
Braised Turnips with Saffron	5 min	*35 min**	5 min	250 g
Duck Breast, optionally cryorendered and cryoseared see page 3·124	1 h		30 min	500 g (about two breasts)

**(unattended times)*

ASSEMBLY:

Cook duck breasts sous vide in **56** °C / **133** °F bath to core temperature of **55** °C / **131** °F, about 25 min.

While duck breasts are cooking:

Reheat sealed turnips in **70** °C / **158** °F bath.

Reheat date puree and jus.

Remove breasts from bag, and pat dry. Allow to rest for 10 min in a warm, dry place.

While duck breasts are resting:

Warm quince jelly in **70** °C / **160** °F oven until just heated through, about 5 min.

Cryosear duck breasts (see page 3·124), or sear breasts, skin side down, on griddle until skin is crisp, about 4 min.

Cut breasts in slices 1 cm / ⅜ in thick.

Garnish each heated plate with turnips, date puree, and jelly.

Arrange slices of crisped duck breast on each plate.

Finish with jus and spiced honey glass.

POMEGRANATE AND GARUM JUS

Yields 550 g

We prefer a final pH of 4.5 for the jus.

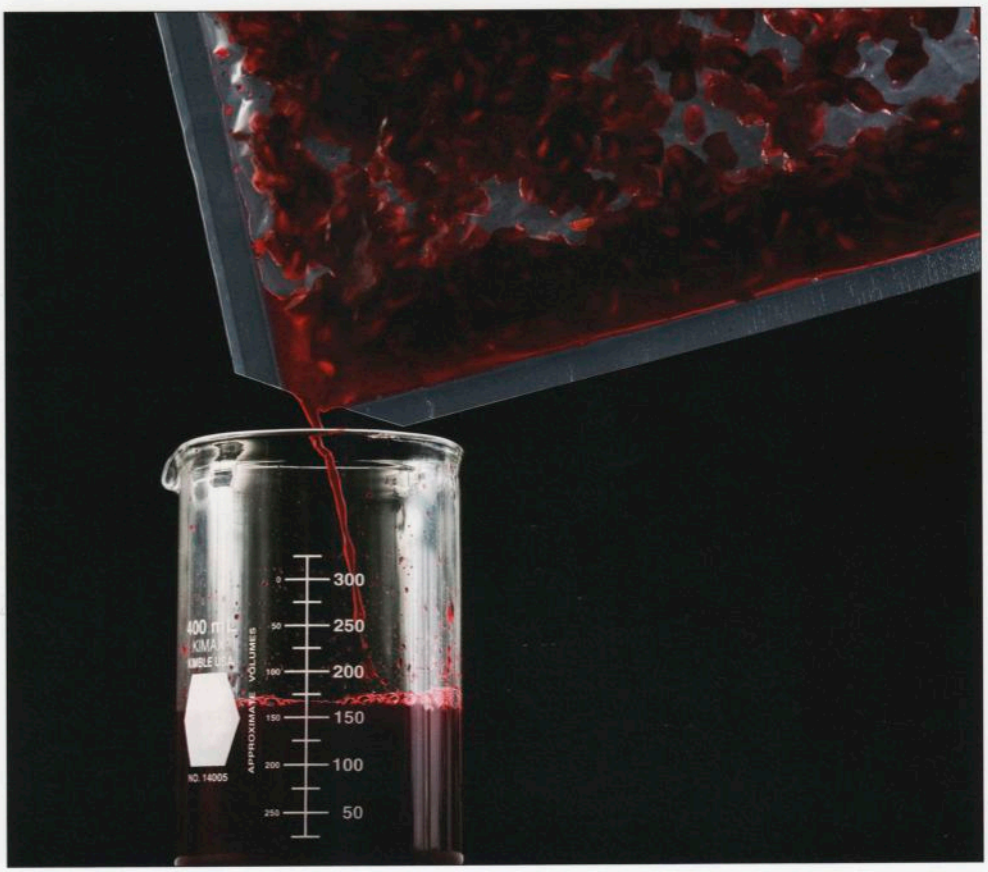
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pomegranate seeds	300 g	150%	① Vacuum seal, then crush with rolling pin. ② Strain through fine sieve, and reserve.
Brown duck stock see page 2·296	200 g	100%	③ Mix into juice. ④ Bring to a boil.
Pomegranate juice, from above	34 g	17%	⑤ Cool.
Garum (or fish sauce)	20 g	10%	
Malt vinegar	as needed		⑥ Add vinegar to adjust pH to taste.
Ultra-Sperse 3 (National Starch brand)	4.8 g	2.4%	⑦ Blend in to thicken. ⑧ Refrigerate.

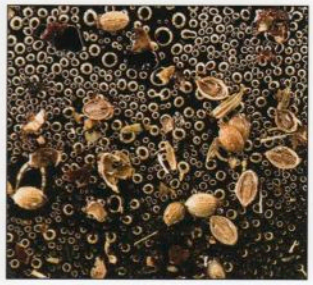
DATE PUREE

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Dates, pitted	300 g	100%	① Vacuum seal together.
Water	90 g	30%	② Cook sous vide in 80 °C / 176 °F bath for 2 h.
Ginger juice	9 g	3%	③ Blend fully.
Salt	1.2 g	0.4%	④ Press through fine sieve.
Black pepper, finely ground	1 g	0.3%	⑤ Discard pulp, and refrigerate puree.
Cardamom pods	0.2 g	0.1%	

Juicing pomegranate seeds (more accurately, the arils that surround the seeds) can be a messy affair. To simplify the process, seal the seeds in a sous vide bag, then crush them with a rolling pin. This technique avoids breaking the bitter seeds and speeds cleanup.





Making paper-thin, crisp sugar glass is easy if you first make a hard caramel from the sugar. You can then break up the caramel and grind the pieces to a fine powder. Any garnish, such as crushed spices, can be added on top of the sifted powder before remelting it in the oven. As long as the delicate glass is warm enough to be pliable, it can be cut into pieces.

Many sugars form crispy glasses easily, but honey is not one of them. Honey contains fructose, which is very **hygroscopic** (see page 2·428). Indeed, this is why honey doesn't dry out. We combine spray-dried honey with the nonsweet sugar trehalose to overcome the problem. Store the honey glass in an airtight container along with packets of silica gel to prevent it from absorbing moisture.

SPICED HONEY GLASS

Yields 365 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Honey, spray-dried store-bought	180 g	100%	① Heat together to **160** °C / **320** °F, stirring constantly.
Trehalose (or sugar)	180 g	100%	② Pour onto 27.5 cm by 40 cm / 11 in by 16 in silicone mat, and cool until hardened.
Water	45 g	25%	③ Break glass into shards, and grind to fine powder.
			④ Pass powder through fine sieve onto baking sheet lined with silicone mat, forming layer 1.5 mm / 1/16 in thick.
Coriander seeds, toasted	4 g	2%	⑤ Crush spices together to make coarse powder.
			⑥ Use fine sieve to remove fine particles.
			⑦ Sprinkle coarse particles evenly over sugar powder.
Sichuan peppercorns	2.5 g	1.5%	⑧ Bake in **150** °C / **300** °F oven until completely melted, about 6 min.
Fennel seeds	2 g	1%	
Black pepper, coarsely ground	1.5 g	0.8%	⑨ Cut into 2.5 cm by 7.5 cm / 1 in by 3 in pieces while still hot and pliable.

BRAISED TURNIPS WITH SAFFRON

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Turnips, peeled and cut to slices 5 mm / ¼ in thick	250 g	100%	① Vacuum seal together.
			② Cook sous vide in **85** °C / **185** °F bath for 35 min.
			③ Refrigerate in bag.
Water	100 g	40%	
Saffron threads	2 g	0.8%	
Salt	2 g	0.8%	

PIGEON EN SALMIS

Blood pudding, brioche, grain ragout, celery root

For most of history, it has been important economically to use up leftovers, especially when they were splendid and expensive. In the 19th century, Victorians prized their costly game birds. Charles Dickens wrote that one gluttonous English lord so loved them, he was metaphorically "pelted constantly with roast partridges, which he caught in his ravening jaws just as a French poodle would macaroons." You certainly couldn't let the lovely cold birds go to waste. So cooks went to work making a salmis: leftover meat in a rich, winey broth, served over pieces of day-old bread panfried in butter.

We deconstructed the classic salmis with pigeon, making it a three-course exercise in frugality, with luxe touches. Here, the jus and blood become a custard of *boudin noir*, or blood sausage, infused into day-old brioche, which is revived as *pain perdu*, a French toast. The second course is tender, sautéed offal on a ragout of wild grains, like those a partridge might eat. Third comes breast meat, sliced and flavored with a magnificent *farce royale* of leg meat, then bathed in a warm, oat jus made with wine and bits of carcass meat. As in Dickens's day, little of the bird is left unused.

YIELD: *four portions*
SPECIAL EQUIPMENT: *Pacojet, pressure cooker, sous vide equipment*
TIME REQUIRED: *13 h overall, including 3 h preparation and 1¼ h to cook and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
FIRST COURSE				
Quatre Epicés see page 2·403	5 min			4 g
Boudin Noir Custard	5 min	10 min and *1 h**		500 g
Boudin Noir Bread Pudding			10 min	200 g
Foie Gras and Hazelnut Ganache	10 min	20 min and *1 h**	3 min	40 g
Maple Vinegar Gastrique	3 min			
Puffed Oats see page 4·302		30 s		40 g
Candied Puffed Oats		10 min		40 g
SECOND COURSE				
Ragout of Grains	5 min	*12 h** and 2¼ h	12 min	280 g
Brown Chicken Jus see page 2·344	15 min	*2 h**		25 g
Sous Vide Pigeon Offal	5 min	*12 h**	12 min	120 g
White Chicken Stock see page 2·301	10 min	*1½ h**		150 g
Madeira Gelée	5 min	20 min		40 g
Pickled Jerusalem Artichokes	10 min			40 g

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
THIRD COURSE				
Brown Pigeon Stock see page 2·296	15 in	*1½ h**		950 g
Farce Royale	25 min			200 g
Roast Pigeon Crown	20 in	*4 h**	1 h	450 g
Toasted Oat Jus	15 min	2 h 35 min	2 min	80 g
Pickled Celery Root	10 min			40 g
Celery Root Mousseline see page 2·427	5 min	*35 min**	2 min	100 g

**(unattended times)*

ASSEMBLY:

FIRST COURSE

Heat oil to **175** °C / **350** °F.
Dust bread pudding with trehalose on all sides.
Deep-fry bread pudding for 3 min.
Heat reserved glucose syrup in nonstick sauté pan over medium-high heat while pudding is frying.
Remove pudding from oil, and pat dry with paper towels. Immediately transfer to sauté pan, and coat with hot glucose syrup.
Cook, flipping constantly, until golden shell forms on all sides, about 3 min.
Transfer to nonstick surface, and allow to cool until shell hardens, about1 min.

While shell on bread pudding is hardening:
Pacotize foie gras ganache once.
Make small quenelles of ganache.
Place piece of bread pudding in center of each plate.
Garnish with one quenelle of ganache and puffed oats.
Spoon gastrique onto each plate.

SECOND COURSE

Sauté mushrooms in duck fat until light golden and tender, about 10 min.
Add grains, and cook through.
Finish with foie gras butter, mushroom stock, and pigeon glaze; season with salt and lemon juice.
Spoon onto each plate.

Meanwhile:
Reheat kidneys and gizzards sous vide in **55** °C / **131** °F bath for 10 min. Brown kidneys gently in neutral oil to achieve golden crust. Slice browned kidneys in half lengthwise and gizzards thinly. Season with salt.
Brown hearts on all sides in duck fat for 2 min. Season with salt.
Arrange kidneys, gizzards, hearts, Madeira gelée cubes, and Jerusalem artichokes on top of grain ragout.
Shave wild mushrooms over dish with fine truffle slicer or mandolin.

THIRD COURSE

Sear prepared pigeon crown in dry, hot nonstick pan, rotating and applying pressure to brown evenly, about 5 min.
Brush with duck fat, and season with salt.
Bake in **65** °C / **150** °F oven for 40 min.

While pigeon is in oven:
Warm celery root mousseline and oats jus. Check seasoning for both.
Allow pigeon to rest for 15 min at room temperature.

While pigeon is resting:
Spoon celery mousseline onto plates.
Carve breasts off crown, and cut into slices 1 cm / ⅜ in thick. Lay over mousseline.
Garnish with pickled celery root.
Dress with warm oat jus.

BOUDIN NOIR CUSTARD

Yields 950 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yellow onions, thinly sliced	100 g	22%	① Sauté until translucent. ② Cool.
Rendered bacon fat	20 g	4.4%	
Whole milk, cold	200 g	44%	③ Disperse gelatin into cold milk.
160 Bloom gelatin	19 g	4.2%	④ Warm until gelatin is fully dissolved.
Heavy cream	450 g	100%	⑤ Combine with cooked onions and milk mixture.
Egg yolks	80 g	18%	⑥ Blend until smooth.
Pigeon blood, fresh	60 g	13%	⑦ Strain through fine sieve.
Salt	14 g	3%	⑧ Vacuum seal.
Dutch-processed cocoa powder	4 g	0.9%	⑨ Cook sous vide in 70 °C / 158 °F bath for 1 h. ⑩ Cool in ice-water bath.
Quatre épices see page 2·403	4 g	0.9%	⑪ Refrigerate.

For more on the steps involved in proper dispersion and hydration of gelatin, see page 4·124. For more on strategies for clarifying juice, see page 2·352.

BOUDIN NOIR BREAD PUDDING

Yields 1 kg

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Day-old brioche, crust removed	500 g	100%	① Cut into slices 2.5 cm / 1 in thick. ② Place slices in bottom of deep hotel pan.
Boudin noir custard, warm, from above	500 g	100%	③ Pour over brioche, and place pan quickly in vacuum chamber. ④ Pull full vacuum twice, turn brioche slices over, and pull vacuum three more times, or as many times as necessary for the bread to fully absorb the custard. ⑤ Refrigerate until set, at least 4 h. ⑥ Cut gelled brioche slices into 3.75 cm / 1½ in by 5 cm / 2 in rectangles. ⑦ Refrigerate.
Frying oil	as needed		⑧ Reserve individually.
Trehalose	as needed		
Glucose syrup DE 40	as needed		
Salt	to taste		

FOIE GRAS AND HAZELNUT GANACHE

Yields 650 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cognac	60 g	20%	① Reduce to 20 g.
Sauternes	30 g	10%	
Sweet onions, finely minced	100 g	33%	② Sweat until tender without coloring, about 10 min.
Rendered duck fat	15 g	5%	
Raw duck foie gras	300 g	100%	③ Puree onions and alcohol reduction until smooth.
Roasted-hazelnut butter	100 g	33%	④ Pass through fine sieve.
Unsalted butter	50 g	16.7%	⑤ Freeze in Pacojet beaker, and reserve for service.
Roasted-hazelnut oil	25 g	8.3%	
Salt	5 g	1.7% *(1%)**	
Insta Cure No.1	3.25 g	1.08% *(0.7%)**	

**(% of total weight of foie gras, hazelnut butter, unsalted butter, and hazelnut oil)*

For more on making nut butters, see page 2·418.

MAPLE VINEGAR GASTRIQUE

Yields 300 g

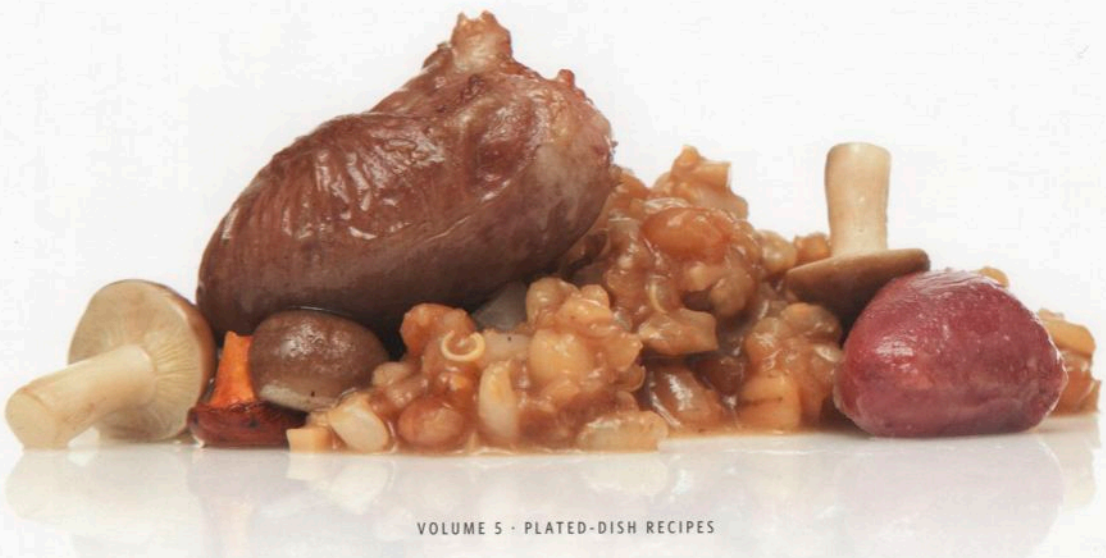
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Maple syrup (Grade B)	175 g	175%	① Whisk together.
Sherry vinegar	100 g	100%	② Vacuum seal.
Cider vinegar	20 g	20%	③ Refrigerate.
Microcrystalline cellulose	3 g	3%	

We used Avicel CG200 microcrystalline cellulose, made by FMC Biopolymer.

CANDIED PUFFED OATS

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Honey	100 g	100%	① Combine.
Trehalose	40 g	40%	② Heat to 185 °C / 365 °F.
Water	20 g	20%	
Baking soda	0.7 g	0.7%	③ Stir into hot sugar mixture.
Puffed oats see page 4·302	40 g	40%	④ Fold into hot sugar mixture.
Cocoa nibs	9 g	9%	⑤ Pour onto silicone baking mat, and allow to set.
Salt	1 g	1%	⑥ Break into small chunks, and reserve in airtight container in cool, dry place.
Quatre épices see page 2·403	0.2 g	0.2%	



RAGOUT OF GRAINS

Yields 280 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Button mushrooms, peeled	2 kg	2,000%	① Coat mushrooms in oil.
Grapeseed oil	100 g	100%	② Roast in 175 °C / 350 °F oven until golden, about 30 min.
Water	800 g	800%	③ Add to roasted mushrooms, and simmer for 1 h. ④ Strain. ⑤ Measure and reserve 1 kg of mushroom stock, divided into four portions, 250 g each. ⑥ Measure and reserve 25 g more of mushroom stock, for use during finishing.
Spelt, soaked for 12 h	35 g	35%	⑦ Pressure-cook with 250 g mushroom stock at a gauge pressure of 1 bar / 15 psi for 12 min. ⑧ Drain, cool, and refrigerate.
Pearl barley, rinsed	40 g	40%	⑨ Pressure-cook with 250 g mushroom stock at a gauge pressure of 1 bar / 15 psi for 12 min. ⑩ Drain, cool, and refrigerate.
Quinoa	35 g	35%	⑪ Pressure-cook with 250 g mushroom stock at a gauge pressure of 1 bar / 15 psi for 2 min. ⑫ Drain, cool, and refrigerate.
Sprouted brown rice	35 g	35%	⑬ Pressure-cook with 250 g mushroom stock at a gauge pressure of 1 bar / 15 psi for 6 min. ⑭ Strain. ⑮ Cool and reserve.
Raw foie gras, brought to room temperature	20 g	20%	⑯ Drain. ⑰ Pass through fine sieve, and whisk with butter to make foie gras butter. ⑱ Vacuum seal, and refrigerate.
Unsalted butter, cubed, brought to room temperature	20 g	20%	
Shiitake mushrooms, finely minced	100 g	100%	⑲ Measure and refrigerate individually.
Shallots, finely minced	75 g	75%	
Seasonal wild mushrooms, finely minced	40 g	40%	
Rendered duck fat	45 g	45%	
Brown chicken jus see page 2-344	25 g	25%	
Mushroom stock, from above	25 g	25%	
Lemon juice	to taste		
Salt	to taste		⑳ Reserve.

The grains are pressure-cooked separately to give each one the optimal texture. Other grains or nuts can be added or substituted (see page 3-300).

Wild seasonal mushrooms such as porcini, matsutake, or saffron milk cap are all excellent choices.

SOUS VIDE PIGEON OFFAL

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pigeon hearts	100 g (four hearts, 25 g each)	100%	① Measure and reserve individually.
Rendered duck fat	50 g	50%	
Cock's kidneys	100 g (four kidneys, 25 g each)	100%	② Vacuum seal. ③ Cook sous vide in 70 °C / 158 °F bath for 20 min. ④ Cool in ice-water bath. ⑤ Refrigerate.
Pigeon gizzards, split and peeled	150 g	100%	⑥ Vacuum seal together. ⑦ Cook sous vide in 60 °C / 140 °F bath for 12 h. ⑧ Cool in ice-water bath. ⑨ Refrigerate.
Rendered duck fat	50 g	33%	
Frying oil	as needed		⑩ Reserve.
Salt	to taste		

Cock's kidneys, gizzards, and other poultry offal can often be found at Asian food markets.

MADEIRA GELÉE

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Madeira wine (dry)	200 g	100%	① Combine.
White chicken stock see page 2·301	150 g	75%	② Bring to simmer. ③ Remove from heat.
Cassia bark, toasted, crushed	2 g	1%	④ Add to hot stock, and infuse for 5 min. ⑤ Strain and cool.
Salt	4 g	2%	⑥ Season cooled liquid.
Low-acyl gellan (Kelcogel F, CP Kelco brand)	2.1 g	1.05% (*0.6%*)*	⑦ Blend into cooled liquid. ⑧ Heat to 95 °C / 203 °F, and hold at temperature for at least 3 min to fully hydrate.
Sodium citrate	0.7 g	0.35% (*0.2%*)*	⑨ Pour a layer 0.5 cm / ¼ in thick into a nonstick mold, and allow 0to set for at least 10 min.
High-acyl gellan (Kelcogel LT100, CP Kelco brand)	0.55 g	0.27% (*0.15%*)*	⑩ Refrigerate until set, about 5 min. ⑪ Cut into cubes, and refrigerate.

(% of total weight of Madeira and chicken consommé*)

For more on using extracts instead of whole spices, see page 2·288.

PICKLED JERUSALEM ARTICHOKES

Yields 280 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Champagne vinegar	150 g	100%	① Combine to make pickling brine.
Sugar	30 g	20%	
Salt	5 g	3.3%	
Jerusalem artichokes, peeled and cut into 0.5 cm / ¼ in cubes	100 g	67%	② Vacuum seal with brine, and refrigerate.

FARCE ROYALE

Yields 300 g

For more on strategies for rendering fat, see page 3-145.

Adding salts and phosphates to meat yields less greasy, more consistent results.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pigeon leg meat, cold	150 g	100%	① Combine, and puree until smooth.
Rendered foie gras fat	10 g	6.7%	
Salt	3 g	2%	
Insta Cure No. 1	1.9 g	1.3%	
Nutrifos 088, dissolved	0.16 g	0.12%	
Brown pigeon stock see page 2-296	200 g	133%	② Reduce stock to 25 g to make glaze.
160 Bloom gelatin	3.25 g	2%	③ Bloom gelatin, and dissolve in glaze. ④ Add meat puree, and cool over ice-water bath.
Pancetta, brunoise	40 g	27%	⑤ Fold into meat mixture until completely incorporated.
Porcini, finely minced	35 g	23%	⑥ Place mixture between two silicone baking mats.
Hazelnuts, skinned and finely minced	35 g	23%	⑦ Roll out with heavy rolling pin; use two dowels 5 mm / ¼ in. in diameter, one on each side of stacked sheets, for calibration.
Garlic, blanched, brunoise	7 g	4.7%	⑧ Refrigerate farce royale until set.
Nutrifos 088 (Astaris brand), dissolved in warm water	0.16 g	0.12%	

ROAST PIGEON CROWN

Yields 800 g

Grouse or partridge make excellent substitutions for the pigeon. Charles Dickens wrote effusively of partridge and its many "pleasant disguises" in the Nov. 21, 1868, issue of *All the Year Round*, a sort of *Ladies' Home Journal* of the day. The piece was titled "Making Game of a Very Serious Subject."

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pigeon crown	600 g	100%	① Remove skin in one piece, making sure to remove skin around arm and shoulder. ② Cut out shape from still-cold skin to fit over crown, using actual crown as template.
Farce royale, from above	200 g	27%	③ Dust farce sheet with Activa, and place over crown. ④ Pull skin over crown. ⑤ Wrap crown tightly in plastic wrap, and vacuum seal. ⑥ Place in vacuum machine on small baking sheet, and pull full vacuum to collapse any residual air pockets. ⑦ Refrigerate for 6 h to allow enzyme to bind proteins.
Activa RM or GS	as needed		
Duck fat	as needed		⑧ Reserve.
Salt	to taste		

TOASTED OAT JUS

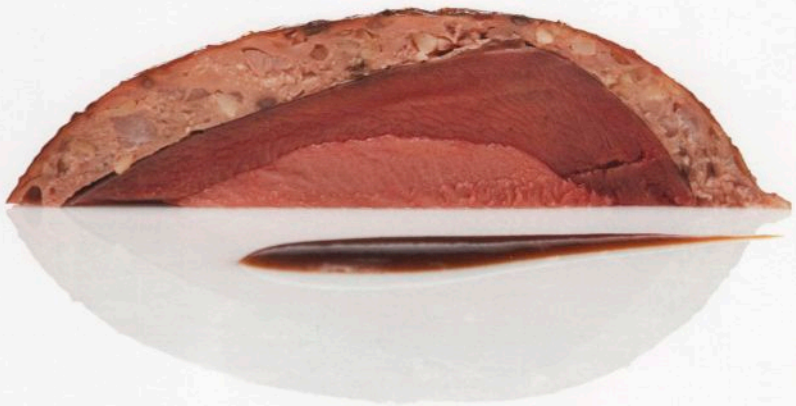
Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pigeon carcass	650 g	87%	① Roast in 175 °C / 350 °F oven until golden, about 35 min.
Pigeon wings	200 g	27%	
Sweet onions, thinly sliced	300 g	40%	② Sauté onions until translucent.
Grapeseed oil	45 g	6%	③ Add garlic, and sauté for 5 min.
Garlic, thinly sliced	10 g	1.3%	
Brown pigeon stock see page 2·296	750 g	100%	④ Combine with roasted carcass and wings plus onion mixture.
Red wine (dry)	300 g	40%	⑤ Bring mixture to simmer.
Rendered foie gras fat	65 g	8.7%	⑥ Skim.
Cognac	50 g	6.7%	⑦ Pressure-cook at a gauge pressure of 1 bar / 15 psi for 1½ h.
Steel-cut oats, rinsed to remove surface starch	30 g	4%	⑧ Strain, and reduce to 250 g.
Sherry vinegar	20 g	2.7%	
Sugar	13 g	1.7%	
Black peppercorns	2 g	0.25%	
Reduced oat jus, from above	250 g	100%	⑨ Combine.
			⑩ Simmer for 25 min.
Pancetta	25 g	10%	⑪ Season
Cognac	7.5 g	3%	⑫ Strain through fine sieve.
Sherry vinegar	5 g	2%	⑬ Refrigerate.
Salt	2.5 g	1%	
Black peppercorns	0.25 g	0.1%	

PICKLED CELERY ROOT

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Celery juice, clarified	125 g (from 250 g of celery)	125%	① Combine to make pickling brine.
White wine vinegar	100 g	100%	
Sugar	30 g	30%	
Salt	5 g	5%	
Celery root, peeled and thinly sliced	100 g	100%	② Vacuum seal with brine.
			③ Refrigerate.
Black peppercorns	1 g	1%	
Coriander seeds, toasted	0.5 g	0.5%	



GUINEA HEN TAGINE

Preserved figs, navel oranges, purple Beldi olives

Djemâa el Fna is the crowded, colorful square at the center of Marrakesh. Slipping into the alleyways of the medina, past old men sipping mint tea, you'll find cinnamon, saffron, and cumin in perfect cones; oranges from the lush Ourika Valley; piles of apricots, raisins, dates, and almonds. All of these find their way into the aromatic Moroccan stews known as tagines, in which poultry, meats, or fish are cooked with fruits, spices, and vegetables. Couscous is often served on the side.

The heavy earthenware pot in which a tagine is typically cooked and served is called a tagine *slaoui*, which desert nomads have long used over open fires. It has a tight-fitting conical lid that traps vaporizing juices in much the same way the lid does when braising a traditional pot roast (see page 2·93). Inside the pot, the trapped moisture raises the humidity, which increases the wet-bulb temperature and speeds cooking. But you don't need the traditional pot to make this tagine. Cooking it sous vide is easier, and gives you far more control.

YIELD: *four portions*
SPECIAL EQUIPMENT: *dehydrator, sous vide equipment, pressure cooker*
OPTIONAL EQUIPMENT: *griddle*
TIME REQUIRED: *5 h overall (4 wk 5 h if making preserved lemon peel), including 2 h preparation and 20 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Preserved lemon peel, brunoise **optional, see page 3·350**	15 min	*4 wk**		185 g
Pickled Figs	10 min	5 min and *4 h**		24 g
Brown Chicken Stock **see page 2·296**	15 min	*1½ h**		325 g
Tagine Base	10 min	½ h	2 min	120 g
Sous Vide Guinea Hen	10 min	*5 h** and *5 h**	20 min	552 g legs, 520 g breast
Puffed Chickpea Salad	5 min	*12 h** and *1¼ h**		150 g
Marinated Navel Oranges	15 min			85 g
Moroccan Batbout Flatbread	15 min	*1 h**	4 min	400 g
GARNISH				
Beldi olives, pitted and thinly sliced				15 g
Flat-leaf parsley leaves				15 g
Almonds, peeled and sliced, toasted				25 g
Cumin seeds, toasted				2 g

**(unattended times)*

ASSEMBLY:

Reheat guinea hen thighs and breasts at **60** °C / **140** °F for about 15 min. Allow to rest for 5 min.

While guinea hen is reheating:

Heat frying oil for chickpeas to **195** °C / **385** °F.

While guinea hen is resting:

Deep-fry chickpeas until puffed. Drain on paper towels, and season.
Panfry bread on lightly oiled griddle or pan until golden and cooked through, about 2 min on each side.
Reheat tagine base.

While bread is frying:

Combine ingredients for the orange salad, and season.
Toss fried chickpeas with tahini dressing and mint leaves.
Slice guinea hen into pieces 1 cm / ⅜ in thick.

To finish:

Arrange guinea hen slices on plates.
Spoon tagine base over meat.
Garnish with cumin, parsley, preserved lemon peel, olives, pickled figs, and almonds.
Serve orange and chickpea salads on the side with the warm bread.

PICKLED FIGS

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Red wine vinegar	350 g	175%	① Vacuum seal together.
Dried black figs	200 g	100%	② Cook sous vide in 80 °C / 176 °F bath for 4 h.
Sugar	200 g	100%	③ Cool completely.
White balsamic vinegar	195 g	97.5%	④ Refrigerate.
Balsamic vinegar	125 g	62.5%	
Lemon, thinly sliced	20 g	10%	
Ginger, peeled and thinly sliced	4 g	2%	
Cinnamon stick	3.5 g	1.75%	
Star anise, crushed	1.5 g	0.75%	
Cardamom seeds, black	0.5 g	0.25%	
Black peppercorns	0.2 g	0.1%	

TAGINE BASE

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	100 g	100%	① Sauté onions until translucent.
Neutral oil	25 g	25%	
Brown chicken stock see page 2-296	325 g	325%	② Add, and bring to simmer. ③ Reduce by half, about 20 min.
Ginger juice	21 g	21%	
Water	10 g	10%	
Garlic, thinly sliced	9 g	9%	
Lemon juice	9 g	9%	
Clear honey	5 g	5%	
Salt	3.5 g	3.5%	
Cinnamon, freshly ground	1 g	1%	
Preserved lemon peel, brunoise see page 3-350	8.5 g	8.5%	④ Add to onion mixture. ⑤ Vacuum seal.
Pickled fig, small dice, from above	6 g	6%	⑥ Refrigerate.
Saffron threads	1 g	1%	

SOUS VIDE GUINEA HEN

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Live culture Greek-style strained yogurt	50 g	33%	① Combine.
Garlic, thinly sliced	25 g	16.5%	
Guinea hen breasts, boneless and skinless	150 g	100%	② Vacuum seal 25 g of yogurt mixture with breasts. ③ Vacuum seal remaining 25 g of yogurt mixture with thighs.
Guinea hen thighs, boneless and skinless	150 g	100%	④ Marinate breasts and thighs, refrigerated, for 5 h. ⑤ Cook thighs sous vide in 62 °C / 144 °F bath for 5 h. ⑥ Cook breasts sous vide in 55 °C / 131 °F bath to core temperature of 54 °C / 129 °F, about 30 min. Hold breasts at temperature for 12 min to ensure proper pasteurization. ⑦ Cool thighs and breasts in ice-water bath. ⑧ Refrigerate.

Marinating the guinea hen in yogurt inoculates the surface of the meat with a live culture. These lactic acid bacteria will produce some characteristic flavors. They also introduce some lactic acid onto the meat's surface, and this, too, contributes to a distinctive taste. Tandoori chicken, the classic Indian dish, uses a yogurt-based marinade to the same end. Chicken may be substituted for guinea hen in this recipe.

PUFFED CHICKPEA SALAD INSPIRED BY WYLIE DUFRESNE

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	350 g	125%	① Soak chickpeas in water for 12 h.
Chickpeas	280 g	100%	② Pressure-cook at a gauge pressure of 1 bar / 15 psi until tender, about 25 min.
			③ Dehydrate at 50 °C / 122 °F for 45 min.
			④ Store in an airtight container, in dry, cool place.
Tahini paste	12 g	4.3%	⑤ Blend to make dressing.
Extra-virgin olive oil	5 g	2%	
Lemon juice	2.2 g	1%	
Sumac	0.5 g	0.2%	
Salt	to taste		⑥ Season dressing.
Small mint leaves	0.9 g	0.3%	⑦ Reserve individually.
Frying oil	as needed		

For more on the steps involved in making puffed chickpeas, see page 4·302.

NAVEL ORANGE SALAD

Yields 80 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Navel orange, supremed	55 g	100%	① Reserve individually.
Sweet red onion, small dice	10 g	18%	
Beldi olives, pitted	8 g	14.5%	
Cumin seeds, toasted and coarsely crushed	4 g	7%	
Argan oil	2.5 g	4.5%	
Lime juice	1.8 g	3.5%	
Paprika	1.5 g	2.5%	
Cilantro, fine julienne	1 g	2%	
Orange blossom water	0.2 g	0.4%	

MOROCCAN BATBOUT FLATBREAD

Yields 725 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water, lukewarm	320 g	107%	① Sprinkle yeast over water, and stir to dissolve.
Active dry yeast	7 g	2.3%	② Let rest for 5 min.
All-purpose flour	300 g	100%	③ Mix with yeast mixture.
Fine semolina flour	100 g	33%	④ Knead dough for 10 min.
Salt	8 g	2.7%	⑤ Divide into three equal portions.
Turmeric, peeled and finely grated	4 g	1.3%	⑥ Let rise at room temperature until doubled in volume, about 1 h.
Golden oregano, finely minced	1.5 g	0.5%	⑦ Flatten each portion into disc 1 cm / ⅜ in thick.
			⑧ Garnish with herbs.
			⑨ Refrigerate for up to 4 h.
Frying oil	as needed		⑩ Reserve.

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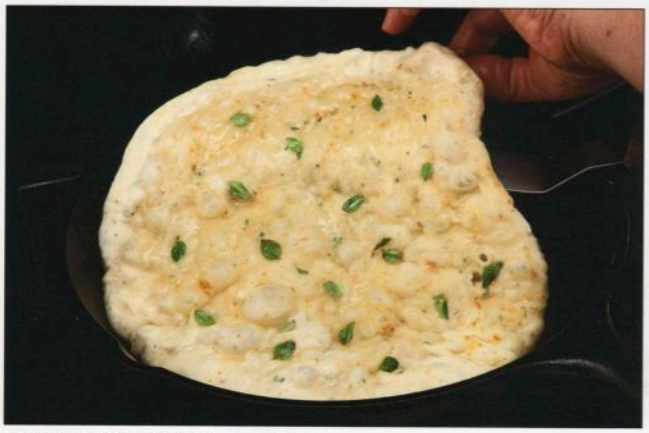


The flatbread is panfried during assembly.

FISH

FISH AND CHIPS

Malt vinegar powder, pommes soufflées, sea urchin tartar

Fish is easy to overcook. Too often, by the time the inside is done, the outside is ruined. Batter is one solution to this problem. Batter takes a lot of energy to heat, so it moderates the cooking temperature of the fish. The hot frying oil dries the batter—not the fish—to a crisp, and as the water in the batter evaporates, the process crisps the fish's outer layers. Batter made with alcohol, such as beer, works even better. Alcohol evaporates faster than water does, so the fish cooks both faster and more gently, finishing with just the right crust.

Ideally, a crispy crust shatters in your mouth. To achieve that, you need a batter with many weak spots that will break all at once: a foam. Not only does the foam further insulate the fish from the hot oil, but the millions of air bubbles in it form a delicate, flaky crust. Use a whipping siphon to dispense a little batter into a bowl, then dip the fish quickly. Toss it in the deep fryer, and you get crispy perfection.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, whipping siphon*
OPTIONAL EQUIPMENT: *spray dryer*
TIME REQUIRED: *12 h overall (2 h if using store-bought malt vinegar powder), including 2 h preparation and 10 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Spray-dried Malt Vinegar Powder optional, see page 4·34		*12 h**		15 g
White Fish Stock see page 2·296	15 min	1¼ h		70 g
Halibut Cheeks	5 min	7 min	4 min	400 g
Halibut Cheek Gel Base	45 min	3 min		180 g
Siphoned Tempura Batter see page 3·332	5 min			100 g
Sea Urchin Tartar Sauce	10 min	*30 min**	1 min	200 g
Pommes Soufflées	30 min	10 min	3 min	200 g

*(*unattended times*)

ASSEMBLY:

Charge batter-filled siphon with two nitrous oxide cartridges.
Deep-fry pommes soufflées in **200** °C / **390** °F oil for 2–3 min.
Drain on paper towels. Season with salt, and reserve warm.

Preheat frying oil for halibut cheeks to **190** °C / **375** °F.
Roll skewered halibut cheeks in Trisol, coating them evenly.
Dispense some batter into bowl, and dip dusted halibut, coating evenly with batter.

Deep-fry halibut cheeks for about 4 min. Rotate cheeks in oil as they fry, and drizzle more batter on them with fork. This will encase cheeks in web of lacy, crunchy batter.
Dust cheeks with malt vinegar powder, and season with salt.
Arrange cheeks and potatoes on plates, and serve with sea urchin tartar sauce.

HALIBUT CHEEK

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Halibut cheeks, trimmed of connective tissue	400 g (four portions, 100 g each)	100%	① Thread on 20 cm / 8 in skewers. ② Refrigerate.
Salt	to taste		③ Reserve.

For more on making Crispy Halibut Cheek, including the full step-by-step procedure, see page 3·334.

HALIBUT CHEEK GEL BASE

Yields 180 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White fish stock see page 2·296	400 g	100%	① Reduce stock to 150 g.
Malt vinegar	30 g	7.5%	② Mix with reduced stock.
Salt	4 g	1%	③ Cool fish stock mixture completely.
Fish stock mixture, from above	150 g	45%	④ Disperse gellans and sodium citrate in cold stock mixture.
Low-acyl gellan (Kelcogel F, CP Kelco brand)	0.75 g	0.19% (*0.5%*)*	⑤ Heat to 95 °C / 203 °F, and hold at temperature for 3 min to fully hydrate.
Sodium citrate	0.36 g	0.1% (*0.2%*)*	⑥ Keep gel mixture above 65 °C / 149 °F to prevent it from gelling prematurely.
High-acyl gellan (Kelcogel LT100, CP Kelco brand)	0.36 g	0.1% (*0.2%*)*	
Halibut cheeks, from above	400 g	100%	⑦ Dip skewered cheeks into hot gelled stock three times, allowing gel to set between dips. ⑧ Place coated cheeks on silicone baking mat. ⑨ Refrigerate for 1 h to cool and set.

(% of total weight of reduced fish stock*)

For more on coating fish with gel, see page 4·150. For other suggested gelling agents, see page 4·150.

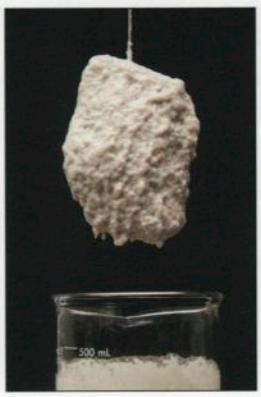
SIPHONED TEMPURA BATTER

Yields 860 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
All-purpose flour	200 g	100%	① Whisk together dry, and reserve.
Rice flour	200 g	100%	
Salt	4 g	2%	
Baking powder	3 g	1.5%	
Vodka	350 g	175%	② Whisk together.
Water	200 g	100%	③ Whisk in dry flour mixture.
Malt syrup	12 g	6%	④ Place batter in 1 l siphon. ⑤ Refrigerate.
Frying oil	as needed		⑥ Reserve.
Trisol (Texturas brand)	as needed		

For more on making a foam batter, see page 3·334.

Trisol can be replaced by other modified starches, such as Batterbind S from National Starch or simply a commodity starch such as rice flour or tapioca.



SEA URCHIN TARTAR SAUCE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Egg	60 g	71%	① Vacuum seal.
			② Cook sous vide in 65 °C / 149 °F bath for 30 min.
			③ Chill in ice-water bath.
			④ Peel.
Lime juice	7 g	8.5%	⑤ Blend with cooked egg.
Dijon mustard	5 g	6%	
Grapeseed oil	85 g	100%	⑥ Drizzle into egg mixture while blending, until fully emulsified.
			⑦ Reserve.
Sea urchin tongues	75 g	88%	⑧ Pass through fine sieve.
			⑨ Blend into egg emulsion.
Cornichons, finely minced	28 g	33%	⑩ Fold into sauce.
Scallions, finely minced	20 g	2%	
Garlic chives, fine brunoise	7.5 g	9%	
Parsley, finely minced	7 g	8.5%	
Chervil, finely minced	4.7 g	5.5%	
Tarragon, finely minced	1.8 g	2%	
Salt	1.5 g	2%	⑪ Season sauce.
Black pepper	0.5 g	0.6%	⑫ Refrigerate.
Cayenne pepper	0.3 g	0.4%	

POMMES SOUFFLÉES

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Russet potatoes	400 g	100%	① Cut potatoes into ovals 3.5 mm / 3/16 in thick.
Frying oil	as needed		② Parcook in 143 °C / 290 °F oil until potatoes blister and puff slightly, 7–9 min.
Salt	to taste		③ Drain, and cool completely.
			④ Reserve salt and more frying oil.

For more on making pommes soufflées, including a step-by-step procedure, see page 4·306.

To ensure good puffing, the dry matter content of the potato must be just right at around 19%–22%.

HAMACHI MALTAISE

Blood orange, asparagus, egg yolk, spaghetti squash

Sauce Maltaise is a classic French sauce that builds on hollandaise sauce by adding the juice of a blood orange. *Sauce Maltaise* is both sweeter and more colorful than hollandaise, and it is often served with asparagus. The name comes from the fact that blood oranges were at one point grown in Malta, although most blood orange varieties originated in spontaneous mutations of ordinary oranges grown in either Sicily or Spain. The varieties were then propagated by grafting. The color of the blood orange comes from anthocyanin, a red pigment that is not usually found in oranges but is common in other red fruits and vegetables, including blackberries and hibiscus.

Here we upgrade the *sauce Maltaise* to a sabayon, a foam traditionally stabilized by using egg yolks but here made in a Modernist way with an egg-yolk fluid gel and a whipping siphon. The sabayon is paired with the traditional asparagus but also with seared hamachi.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, whipping siphon*
TIME REQUIRED: *1 h 20 min overall, including 35 min preparation and 15 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Blood Orange Sabayon	5 min	20 min	*10 min**	250 g
Confit Egg Yolk Puree	5 min	*45 min**		120 g
Sous Vide Green Asparagus	5 min		*10 min**	200 g
Sous Vide White Asparagus	3 min	*7 min**	2 min	200 g
Marinated Spaghetti Squash	10 min	15 min	*10 min**	120 g
Seared Hamachi	5 min		2 min	four portions, 125 g each
GARNISH				
Brown butter, warm see page 4·213				70 g
Blood oranges				12 supremes
Lemon balm leaves				12

**(unattended times)*

ASSEMBLY:

Warm sabayon-filled siphon in **65** °C / **150** °F bath for at least 20 min.
Charge siphon with two nitrous oxide cartridges.
Marinate squash in orange juice–honey vinegar dressing for 10 min.
Vacuum seal green asparagus with water, oil, and salt; cook sous vide in **85** °C / **185** °F bath for 10 min.

While squash is marinating:

Sear hamachi in very hot frying pan on one side only, basting constantly with brown butter, to core temperature of **32** °C / **90** °F, about 2 min. Season with salt.
Sear white asparagus cut side down, until golden, while basting with clarified butter, until just warmed through.
Arrange hamachi and green and white asparagus evenly among four heatproof plates.
Heat under broiler for 15 s to ensure hamachi and asparagus are warmed through.
Dot each plate with egg yolk confit.
Finish the pieces of fish with warm brown butter.
Garnish with marinated squash, blood orange supremes, and lemon balm leaves.
Dispense blood orange sabayon into serving vessel, and serve alongside hamachi.

BLOOD ORANGE SABAYON

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shallots, finely minced	75 g	29%	① Sweat until tender, about 7 min.
Clarified unsalted butter	50 g	19%	
White wine (dry)	450 g	173%	② Add to shallots, and reduce to 120 g.
White wine vinegar	20 g	7.7%	③ Reserve.
Blood orange juice	260 g	100%	④ Reduce orange juice to 30 g.
Unsalted butter, melted	62 g	24%	⑤ Combine with shallot and orange juice reductions to make sabayon base.
Egg yolk, cooked in 65 °C / 149 °F bath for 35 min	48 g	18.5%	⑥ Transfer to 1 l whipping siphon.
			⑦ Refrigerate.
Spray-dried blood-orange juice	40 g	15%	
Heavy cream	38 g	14.6%	
Lemon juice	15 g	5.8%	
Salt	4 g	1.5%	
Xanthan gum	0.2 g	0.08% (*0.06%*)*	

(% of total weight of shallot and orange juice reductions and other base ingredients*)

The spray-dried blood-orange juice can be purchased from Obipektin, or see page 2·443 for a recipe.

For more on spray-drying, see page 2·438.

CONFIT EGG YOLK PUREE

Yields 110 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Egg yolks, blended	100 g	100%	① Vacuum seal.
			② Cook sous vide in 69 °C / 156 °F bath for 45 min.
Champagne vinegar	8 g	8%	③ Puree with egg yolks.
Glucose syrup DE40	4 g	4%	
Salt	to taste		④ Season puree, and refrigerate.

SOUS VIDE GREEN ASPARAGUS

Yields 200 g

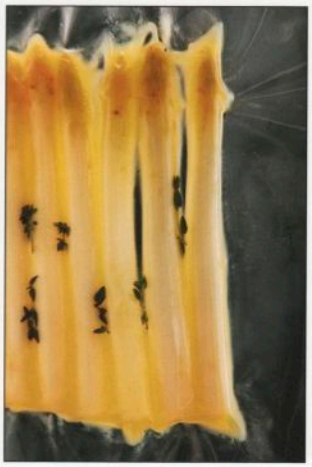
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Green asparagus, stalks peeled (about 1.5 cm / ⅝ in thick)	200 g	100%	① Measure and refrigerate.
Water	20 g	10%	② Measure and reserve individually.
Extra-virgin olive oil	10 g	5%	
Salt	2 g	1%	

Sauce Maltaise is usually served over asparagus, but its bright citrus flavor also works well with hamachi.

SOUS VIDE WHITE ASPARAGUS

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White asparagus, stalks peeled (about 1.5 cm / ⅝ in thick)	200 g	100%	① Vacuum seal together. ② Cook sous vide in 89 °C / 192 °F bath for 7 min. ③ Cool in ice-water bath.
Clarified unsalted butter	20 g	10%	④ Cut each spear lengthwise three-fourths of the way through.
Salt	2 g	1%	⑤ Refrigerate.



MARINATED SPAGHETTI SQUASH

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Spaghetti squash	130 g	100%	① Steam until tender, about 15 min. ② Shred strands while still hot. ③ Cool and refrigerate.
Orange juice	24 g	18.5%	④ Combine to make dressing.
Honey vinegar	11 g	8.5%	⑤ Refrigerate.
Extra-virgin olive oil	8 g	6.2%	
Sichuan peppercorns, coarsely ground	2 g	1.5%	
Orange zest, finely grated	0.5 g	0.4%	
Acetaldehyde	0.015 g	0.01%	
Salt	to taste		

Acetaldehyde is the component that gives fresh citrus juice its distinctive fresh flavor. Adding a small amount enlivens the dish. It is important to safely store and handle the concentrated chemical.

SEARED HAMACHI

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Hamachi belly or fillet	500 g	100%	① Cut into four equal rectangles, and refrigerate.
Brown butter see page 4·213	75 g	15%	② Measure and reserve individually.
Salt	5 g	1%	

Other delicate white fish—including sole, monkfish, John Dory, and black cod—can be substituted for hamachi.

MONKFISH WITH MEDITERRANEAN FLAVORS

Zucchini blossom beignet with halibut brandade filling, spice mix emulsion, mussels

Truth be told, the monkfish is not the most beautiful fish in the sea. It is a predator that waits motionless on the bottom, blending in with rocks and debris. It is also called an anglerfish, because it dangles from its head a long spine with a soft fleshy end that twitches like a worm. When a fish comes in for the bait, the monkfish distends its enormous jaws; it can swallow fish as long as its own body. Six of the seven species of monkfish (sometimes also called goosefish) live in the Atlantic. One species extends into the Mediterranean, and another is found in the western Indian Ocean. Monkfish are strangely absent from most of the Pacific, however, with just one species that swims along the coasts of East Asia.

Chefs prize monkfish for the tail meat; the texture of the meat reminds some people of lobster. Indeed, it was once called "poor man's lobster" but grew so popular that it became more costly than the real thing. Here, we cook monkfish sous vide and garnish it with a zucchini beignet stuffed with a halibut brandade.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, whipping siphon*
TIME REQUIRED: *49 h overall (15 d if making Salted Halibut), including 1 h preparation and 30 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Salted Halibut **optional, see page 3·187**		*12 h** and *15 d**		160 g
Pâte à Choux	5 min	*12 h** and 10 min		750 g
Halibut Brandade		*2 d** and 1 h 20 min		640 g
Zucchini Blossom Beignets	10 min		5 min	four
Sous Vide Mussels	10 min	3 min	*15 min**	450 g
Fish Spice Mix	5 min			10 g
Spice Mix Emulsion	5 min	20 min	2 min	250 g
Sous Vide Monkfish Pavé	25 min	*45 min**	*25 min**	400 g (four fillets, 100 g each)
GARNISH				
Green almonds				12

*(*unattended times*)

ASSEMBLY:

Cook monkfish sous vide at **48** °C / **119** °F to core temperature of **47** °C / **117** °F, about 25 min.
Cook mussels sous vide at **65** °C / **149** °F for 12 min.

While fish is cooking:
Deep-fry battered zucchini blossoms in **195** °C / **380** °F oil until golden brown, about 3 min. Drain on paper towel-lined tray.

Season with salt.
Warm spice mix emulsion, and adjust seasoning.
Place monkfish pavé on each serving plate.
Garnish each plate with zucchini blossom beignet, cooked mussels, and green almonds, and dust with additional fish spice mix.
Pour spice mix emulsion at table.

PÂTE À CHOUX

Yields 725 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk, heated to 90 °C / 194 °F	250 g	100%	① Disperse Methocel over hot milk, shearing constantly with immersion blender for 3 min.
Methocel SGA 150 (Dow brand)	3.2 g	1.3% (*0.5%*)*	② Vacuum seal. ③ Refrigerate for 12 h to hydrate.
Unsalted butter, melted	70 g	28%	④ Blend with milk, and bring to a boil.
Extra-virgin olive oil	40 g	16%	
Salt	5 g	2%	
Sugar	5 g	2%	
All-purpose flour, sifted	120 g	48%	⑤ Add to hot milk mixture all at once. ⑥ Cook, stirring constantly, until mixture forms ball and pot is coated with shiny film of residual dough, about 5 min.
Eggs	250 g	100%	⑦ Transfer ball of dough to stand mixer. ⑧ Add eggs, one at a time, mixing on low speed with paddle attachment until incorporated. ⑨ Measure 250 g, and reserve.

(% of total weight of milk, butter, olive oil, and eggs*)

HALIBUT BRANDADE

Yields 800 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk	as needed		① Soak halibut in milk for 12 h.
Salted halibut optional, see page 3-187	160 g	100%	② Drain fish, and discard milk.
Garlic, sliced and blanched twice	25 g	16%	③ Repeat steps 1 and 2 three times, for total soaking time of 48 h. Reserve 20 g of liquid from final soaking step. ④ Vacuum seal reserved soaking liquid, halibut, and garlic together. ⑤ Cook sous vide at 58 °C / 135 °F to core temperature of 57 °C / 133 °F, about 20 min. Hold at this core temperature for another 15 min. ⑥ Pulse in food processor until finely shredded.
Water	1 kg	625%	⑦ Vacuum seal potato slices in a thin even layer.
Yukon Gold or other waxy potatoes, thinly sliced	250 g	156%	⑧ Cook sous vide at 90 °C / 194 °F for 45 min. ⑨ Drain potatoes, and pass through ricer.
Extra-virgin olive oil	90 g	56%	⑩ Mix into potatoes. ⑪ Pass through a fine sieve. ⑫ Fold sieved potatoes into halibut-garlic mixture. ⑬ Refrigerate.

The quantity of the whole milk will depend on the size of the fish as well as the shape and size of the container.

Good quality, store-bought salt cod can be substituted for the halibut.

ZUCCHINI BLOSSOM BEIGNETS

Yields 650 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Halibut Brandade, from above	150 g	100%	① Fold together, and reserve.
Pâte à Choux, from above	250 g	166%	
Carbonated water, refrigerated	180 g	120%	② Combine to make batter.
			③ Transfer to 1 l whipping siphon.
All-purpose flour	60 g	40%	④ Charge with three cartridges of nitrous oxide, and shake vigorously.
Tapioca starch	60 g	40%	
Trehalose or isomalt	30 g	20%	
Vodka	20 g	13.5%	
Egg whites	45 g	30%	⑤ Whip to stiff peaks.
			⑥ Fold into brandade and pâte à choux mixture.
			⑦ Transfer to piping bag.
Zucchini blossoms	75 g (about 8)	50%	⑧ Pipe mixture into zucchini blossoms.
Frying oil	as needed		⑨ To serve, dispense batter into open container.
			⑩ Dip stuffed blossoms to coat fully.
			⑪ Deep-fry in 195 °C / 380 °F oil until golden brown, about 3 min.
			⑫ Drain on paper towel-lined tray.
Salt	as needed		⑬ Season.

SOUS VIDE MUSSELS

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Live mussels, rinsed and beards removed	250 g	100%	① Vacuum seal. ② Cook in boiling water for 3 min. ③ Chill in ice-water bath. ④ Shuck, reserving mussels and juice. ⑤ Strain juice, and reserve 120 g for spice mix emulsion.
Shallots, thinly sliced	70 g	28%	⑥ Combine mussels with remaining ingredients.
Fennel, thinly sliced	50 g	20%	⑦ Vacuum seal.
White wine (dry)	50 g	20%	⑧ Refrigerate.
Pastis	5 g	2%	
Preserved lemon zest, minced see page 3-350	2 g	1%	
Bay leaves	0.5 g	0.2%	

FISH SPICE MIX

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Hazelnuts, peeled, roasted, and coarsely ground	24 g	100%	① Prepare ingredients as noted. ② Combine in mortar or food processor. ③ Grind to coarse powder. ④ Vacuum seal to preserve aroma. ⑤ Refrigerate.
Sesame seeds, toasted	22 g	92%	
Coriander seeds, toasted	6 g	25%	
White poppy seeds, toasted	5 g	22%	
Powdered ginger	2 g	8.5%	
Salt	1.6 g	6.5%	
Dried chamomile, ground	1.2 g	0.5%	

This spice mixture is incredibly versatile. We highly recommend it for sole, turbot, or any similar fish simply panfried in butter.

SPICE-MIX EMULSION

Yields 250 g

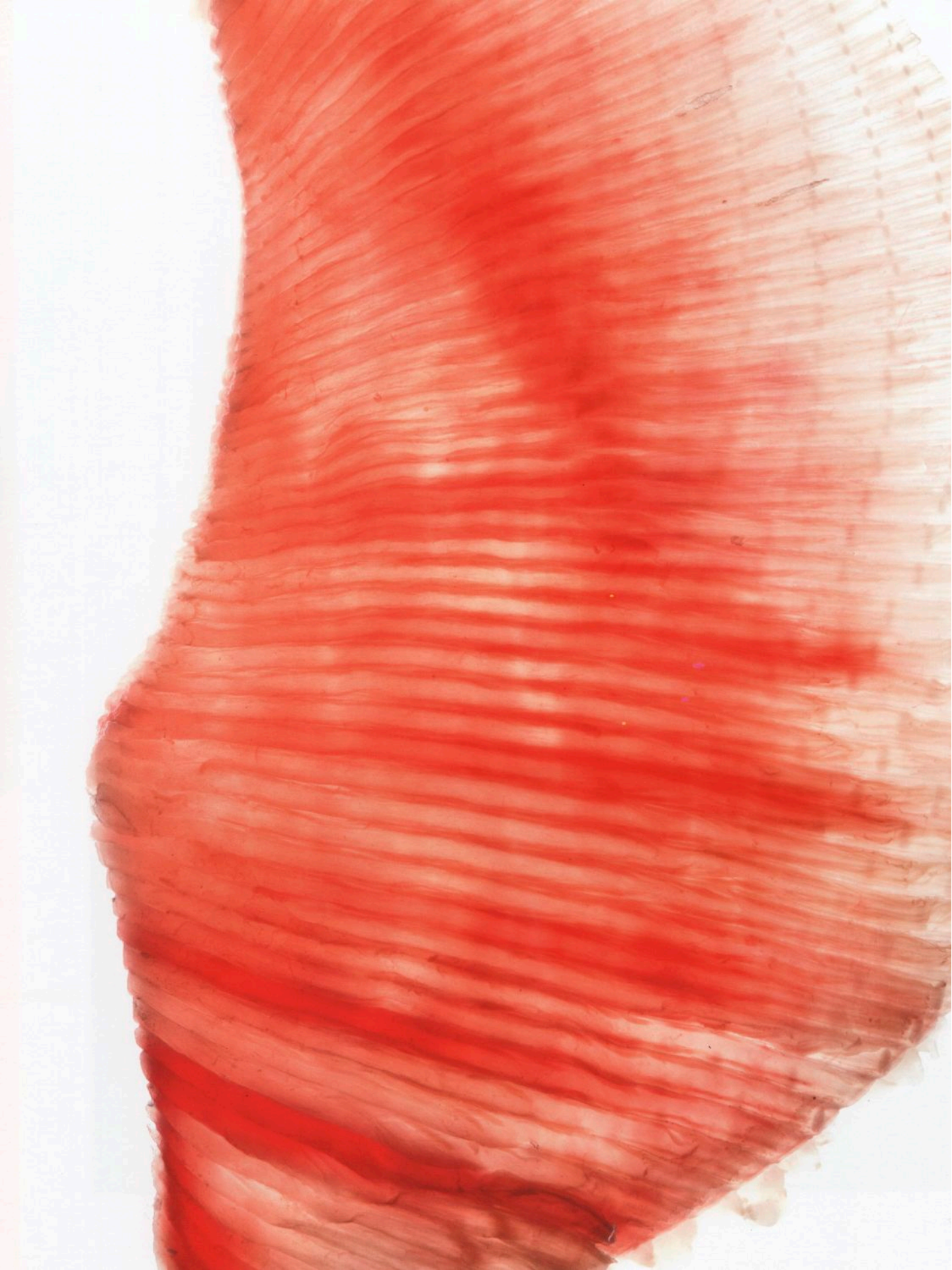
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Unsalted butter	24 g	20%	① Prepare ingredients as noted.
Garlic, finely minced	12 g	10%	② Sauté over medium heat until fragrant.
Ginger, finely minced	6 g	5%	
Anchovy fillets, finely minced	5 g	4%	
Mussel juice, from above	120 g	100%	③ Deglaze pan, and reduce to 100 g.
Manzanilla sherry	48 g	40%	
Xanthan gum	0.2 g	0.17% (*0.15%*)*	④ Blend into reduction.
Extra-virgin olive oil	30 g	25%	⑤ Blend into mixture until emulsified.
Fish spice mix, from above	20 g	17%	⑥ Season mixture.
			⑦ Cool and refrigerate.
Champagne vinegar	to taste		

(% of total weight of mussel-sherry reduction and olive oil*)

SOUS VIDE MONKFISH PAVÉ

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Salt	28 g	7%	① Combine to make cure.
Lemon zest, grated	0.4 g	0.1%	
Monkfish fillet	400 g	100%	② Dust cure evenly over all surfaces of fillet.
			③ Vacuum seal, and refrigerate for 45 min.
			④ Rinse fillet, and pat dry.
Extra-virgin olive oil	as needed		⑤ Cut cured monkfish into four squares of 100 g each.
			⑥ Brush surface of each square with olive oil.
Baby zucchini, sliced 1 mm / 1/16 in thick	200 g	50%	⑦ Lay zucchini slices neatly and in overlapping fashion, on surface of each square to resemble fish scales.
Extra-virgin olive oil	80 g	20%	⑧ Vacuum seal each square individually with 20 g of olive oil.
			⑨ Refrigerate.



SKATE IN BLACK BUTTER

Black butter, caper droplets, Meyer lemon, toasted bread

Biologists classify skates as members of the subfamily called elasmobranchs, which also includes sharks and rays. All members of this subfamily have rough skin with embedded scales, five to seven gills, and skeletons made of cartilage rather than bone. Rays are the closest relatives of skates, and the two look very similar. The difference is that some rays have stingers with which they can inflict injury—skates do not. Rays also give birth to live young (as do some sharks), whereas skates lay eggs in an egg case, known as a mermaid's purse, that has a horn at each of its four corners.

Skate has historically been an inexpensive fish, although that is changing as its popularity grows. One problem with cooking skate is that the meat is naturally tapered: thick near the center but thinning dramatically toward the edges. Chef Wylie Dusfresne's solution to this geometric challenge, which we also use here, is to bond two skate wings together with Activa to make a single piece of constant thickness. The classic French preparation is to panfry skate and serve it with brown (or black) butter sauce and capers. Here we follow this flavor profile with spherified capers and carbonated raisins.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, whipping siphon*
TIME REQUIRED: *8 h overall, including 2 h preparation and 35 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Brown Butter Extract see page 2·326	2 min	*5 h*		8 g
Brown Fish Stock see page 2·296	15 min	*1¼ h**		600 g
Brown Butter Fumet	5 min	15 min and *12 h**		120 g
Black Butter Emulsion	10 min	20 min		120 g
Caper Droplets	30 min			50 g
Carbonated Golden Raisins	5 min	*2 h**	*1½ h**	40 g
Preserved Citrus Curd see page 4·234	10 min	5 min		30 g
Skate Pavé with Bread Crust	10 min	*6 h**	*25 min** and 5 min	300 g

**(unattended times)*

ASSEMBLY:

A half hour before raisins are fully carbonated:

Cook skate sous vide in **52** °C / **126** °F bath to core temperature of **51** °C / **124** °F, about 25 min.

While skate is cooking:

Heat black butter emulsion base to a low simmer. Blend in cold butter until fully emulsified; blend in miso, then season with lemon juice.

Reheat brown butter fumet, and adjust seasoning.

Remove skate portions from bags, pat dry on paper towels, and place slice of bread on each. Sear, bread side down, in clarified butter until bread is crisp and golden. Season.

Spoon lemon curd across serving plates. Arrange one portion of fish in center of each plate.

Garnish with caper droplets and carbonated raisins. Serve both sauces on side.

BROWN BUTTER FUMET

Yields 150 g

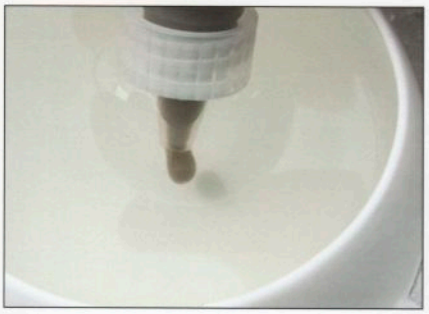
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brown fish stock see page 2·296	200 g	100%	① Simmer together until reduced to 200 g. ② Cool.
Sake	150 g	75%	
Vermouth (dry)	50 g	25%	
Rice vinegar	10 g	5%	
Brown butter extract see page 4·213	8 g	4%	③ Whisk in.
Xanthan gum	0.3 g	0.15%	
Salt	to taste		④ Season and refrigerate.

BLACK BUTTER EMULSION

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brown fish stock see page 2·304	400 g	200%	① Reduce to about 200 g.
Fish stock reduction, from above	200 g	100%	② Blend black butter, soy sauce, and ink into reduced stock.
Black butter, warm see page 4·213	25 g	12.5%	③ Cool and reserve.
White soy sauce	20 g	10%	
Squid ink	2.7 g	1.35%	
Unsalted butter, cold	40 g	20%	④ Measure and reserve individually.
White miso	20 g	10%	
Lemon juice	as needed		

Panfried skate basted in black butter is a classic preparation for a reason: it's great.



These liquid droplets are fashioned to look like capers, in the style of elBulli's liquid olives. Black butter often is served with capers and lemon for an essential burst of acidity.

CAPER DROPLETS

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Capers	90 g	100%	① Blend to fine puree.
White wine vinegar	6 g	6.7%	② Pass through fine sieve.
Caper brine	5 g	5.5%	
Calcium lactate	3 g	3.3% *(3%)**	③ Whisk into caper puree.
Water	500 g	555%	④ Disperse alginate in cold water until fully dissolved, to make setting bath.
Sodium alginate (Algin, Texturas brand)	2.5 g	2.8% *(0.5%)***	⑤ Fill squeeze bottle with caper puree.
			⑥ Expel droplets into bath, and leave for 30 s.
			⑦ Drain droplets, and rinse in fresh water.
Neutral oil	as needed		⑧ Reserve droplets in oil.

*(% of total weight of capers, white wine vinegar, and caper brine)
**(% of total weight of water)

For more on spherification and how to do it, see page 4·184.

CARBONATED GOLDEN RAISINS

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Verjuice (store-bought)	125 g	250%	① Combine.
Golden raisins	50 g	100%	② Hydrate in refrigerator for 2 h.
Water	10 g	20%	③ Transfer to carbonating siphon, and charge with three carbon dioxide cartridges for 1½ h before serving.

For more on carbonation, including step-by-step procedures and alternative methods, see page 2·469.

SKATE PAVÉ WITH BREAD CRUST

Yields 480 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Skate wings	600 g (four 125 g wings)	100%	① Dust evenly with Activa, ensuring grain of all wings is facing in same direction.
Activa RM (Ajinomoto brand)	as needed		② Stack wings, alternating thick and thin ends, and vacuum seal.
			③ Refrigerate for at least 6 h so proteins bond.
			④ Remove from bag, and cut into 100 g squares.
			⑤ Vacuum seal individually, and refrigerate.
White bread, crustless and cut into four slices, 3 mm / ⅛ in thick	80 g	13%	⑥ Cut bread slices into squares slightly larger than skate squares, and reserve.
Clarified unsalted butter see page 4·213	as needed		⑦ Reserve individually.
Salt	to taste		

For more on using Activa, see page 3·250.

SALMON RUS

Salmon oil, smoked butter, root vegetables, cryopoached dill meringue

Across western Russia, you will find lightly cured salmon on any smorgasbord. How did this staple of Scandinavia find its way there? We speculate that the seafaring tribe of Vikings called the Rus, who founded Kiev in the 9th century, brought their salmon with them. Curing the salmon allowed them to preserve it for long ocean voyages; it also made the salmon incredibly salty, however.

Here, we cure the salmon lightly, then cook it sous vide at a low temperature to produce a result that preserves the delicate qualities of the fish. A foamy dill–vodka meringue, poached in liquid nitrogen, is first served to refresh the palate. It introduces traditional Scandinavian flavors—but with a contemporary twist.

We garnish the fish with a jus made from the cooking juices of the salmon and root vegetables. Cold-smoked butter is added during the finishing steps. As a final touch, we add salmon skins that have been puffed into crispy pillows. It is a Modernist interpretation of a palatial feast.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, Dewar bowl, liquid nitrogen, whipping siphon*
OPTIONAL EQUIPMENT: *smoking equipment*
TIME REQUIRED: *25 h overall, including 1½ h preparation and 30 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Cold-smoked Butter optional, see page 4-100		*24 h**		70 g
Sous Vide Salmon	10 min	*7 h**	25 min	400 g (four portions)
Puffed Salmon Skin Pillows	15 min	*3 h** and *5 h**	8 min	35 g
Root Vegetable Jus	25 min	*4 h**	3 min	50 g
Salmon Oil Cream see page 4-236	5 min	*1 h**		80 g
Carrot and Dill Fricassee	10 min	40 min	5 min	125 g
Cryopoached Dill Meringue	25 min		2 min	250 g
GARNISH				
Dill sprigs				eight
Smoked salt				as needed
Golden trout roe or salmon roe				40 g

**(unattended times)*

ASSEMBLY:

Preheat oil for salmon skin pillows to **175** °C / **350** °F.

Cook salmon sous vide in **41** °C / **106** °F bath to core temperature of **40** °C / **104** °F, about 25 min.

While salmon is cooking:

Dispense mousse onto spoon to form small egg-shaped ball.

Drop ball into liquid nitrogen. Scoop liquid nitrogen over mousse, turn ball, and poach other side. Poach until crispy on outside and soft in center, no more than 10 s.

Serve immediately. Each ball should be eaten in a single bite.

Deep-fry salmon skin pillows until golden and puffed, about 8 min. Drain, and season with salt.

After palate cleanser has been served:

Warm carrot fricassee, about 5 min. Season with reserved ingredients.

Warm root vegetable jus.

Blend in smoked butter until fully emulsified.

Season with lime juice and salt.

Arrange salmon and carrot fricassee on each plate.

Garnish with dots of salmon oil cream and a spoonful of roe, and season fish with dill sprigs and smoked salt.

Serve salmon skin pillows on side.

Pour jus at table.

Be careful not to freeze the meringue for more than 10 s. It can burn a diner's lip or tongue and be quite painful.

SOUS VIDE SALMON

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	150 g	37.5%	① Whisk together until sugar is fully dissolved to form brine.
Salt	9 g	2.3%	
Sugar	5 g	1.25%	
Salmon fillet (preferably wild king)	400 g	100%	② Cut into four 100 g portions. ③ Soak in brine for 7 h. ④ Drain.
Extra-virgin olive oil	80 g	20%	⑤ Vacuum seal each salmon portion with 30 g of oil. ⑥ Refrigerate.

The salmon can be served using smoke as a garnish for a dramatic and aromatic effect. For the technique, see page 3·214.

PUFFED SALMON SKIN PILLOWS

Yields 35 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Salmon skin (one intact piece)	25 g	100%	① Vacuum seal. ② Cook sous vide in 85 °C / 185 °F bath for 3 h. ③ Remove from bag to cool. ④ Trim, and cut into at least 24 squares, each measuring 3.5 cm / 1½ in.
Activa GS	5 g	20%	⑤ Whisk together.
Water, 10–25 °C / 50–77 °F	5 g	20%	⑥ Brush on 3 mm / ⅛ in edge of each skin square. ⑦ Sandwich two squares together to seal. ⑧ Repeat to make total of at least 12 sandwiched squares. ⑨ Vacuum seal without overlapping. ⑩ Refrigerate for at least 6 h.
Frying oil	as needed		⑪ Reserve.

Activa seals the salmon skin into a pillow-shaped balloon. The seal must be tight and continuous or it won't puff properly.

ROOT VEGETABLE JUS

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Salmon belly, trim	200 g	200%	① Vacuum seal. ② Cook sous vide in 43 °C / 109 °F bath for 1 h. ③ Strain through fine sieve, and measure 100 g of salmon juice. ④ Refrigerate.
Turnip juice	270 g (from 400 g turnips)	270%	⑤ Vacuum seal together. ⑥ Cook sous vide in 85 °C / 185 °F bath for 3 h. ⑦ Strain through fine sieve. ⑧ Reduce to 200 g.
Rutabaga juice	115 g (from 300 g rutabagas)	115%	
Celery root juice	75 g (from 150 g celery root)	75%	
Sweet onion juice	50 g (from 120 g onions)	50%	
Leek juice	30 g (from 90 g leeks)	30%	
Parsnip juice	15 g (from 65 g parsnips)	15%	
Strained salmon juice, from above	100 g	100%	⑨ Stir into vegetable juice reduction. ⑩ Refrigerate.
Cold-smoked butter see page 4·100	70 g	70%	⑪ Measure and reserve individually.
Lime juice	to taste		
Salt	to taste		

For more on juicing vegetables, see page 2·332.

CARROT AND DILL FRICASSEE

Yields 125 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Carrots, peeled	110 g	100%	① Halve carrot lengthwise, and core.
Extra-virgin olive oil	10 g	9%	② Cut into half-moons 5 mm / ¼ in thick.
			③ Vacuum seal with oil.
			④ Cook sous vide in 85 °C / 185 °F bath for 40 min.
			⑤ Cool in bag in ice-water bath.
Unsalted butter	10 g	9%	⑥ Measure and reserve individually for service.
Ajowan seeds	2 g	1.8%	
Dill	2 g	1.8%	
Semisweet vinegar (honey or white balsamic)	2 g	1.8%	
Salt	to taste		

CRYOPOACHED DILL MERINGUE

Yields 1.2 kg

INSPIRED BY HESTON BLUMENTHAL

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Isomalt	124 g	27.5%	① Combine.
LM Pectin (Genupectin LM104AS, CP Kelco brand)	11 g	2.44%	
Water	260 g	58%	② Whisk isomalt mixture into water. ③ Bring to a simmer. ④ Simmer for 2 min, and remove from heat.
Dill	12 g	2.7%	⑤ Add to isomalt mixture. ⑥ Cover, and steep for 7 min. ⑦ Strain through fine sieve. ⑧ Refrigerate infused mixture.
Cucumber juice	450 g	100%	⑨ Add to infused mixture to form sour base.
Lime juice	133 g	30%	
Egg whites	125 g	28%	⑩ Whisk into sour base.
Vodka	50 g	11%	⑪ Pour into 1 l siphon, and charge with three nitrous oxide cartridges to produce stiff, glossy foam with consistency of shaving cream. ⑫ Refrigerate siphon.

If the foam is collapsing too quickly, reduce the amount of vodka. This is best done by reserving some of the base and diluting the mixture if necessary.

These are assembly steps for cryopoaching the dill meringue. For a full step-by-step procedure for making cryopoached meringues, see page 2·460.

MALAYSIAN STEAMED SNAPPER

Crisped skin, banana leaf, fermented prawn, Malaysian aromatic oil

In the melting pot of flavors that is Malaysia, one simple, traditional dish stands out: fish steamed in a banana leaf. The waxy leaf makes for a perfectly self-contained food parcel: you can cook in it, present food in it, eat from it, and then let it biodegrade. Cooking in the leaf creates a high-humidity environment that prevents the food surface from drying out. The effect is similar to cooking sous vide, except for the lack of temperature control.

People have cooked in banana leaves for centuries. By contrast, the shrimp noodle in this recipe is squarely modern. Chef Wylie Dufresne of wd~50 in Manhattan creates a "pasta" that is 95% shrimp. He purees the shrimp with a dusting of Activa, then extrudes the cohesive puree into hot water to make noodles. Inspired by these ideas, we added the flavors of coconut milk and *belacan* (shrimp paste) to our shrimp noodles, giving them a decidedly Southeast Asian flavor.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment*
OPTIONAL EQUIPMENT: *dehydrator, combi oven*
TIME REQUIRED: *13 h overall, including 45 min preparation and 25 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Crispy Snapper Skin	5 min	3 *h** and 5 *h**		50 g
Malaysian Aromatic Oil	5 min	45 min and *12 h**		25 g
Fermented Shrimp Sheets	5 min	10 min and *12 h**		40 g
Wok-fried Malaysian Vegetables	10 min		2½ min	200 g
Sous Vide Snapper	5 min		20 min	400 g
Green Mango and Cashew Salad	15 min		1 min	250 g
GARNISH				
Mint leaves				15 g
Cilantro leaves				12 g

**(unattended times)*

ASSEMBLY:

Cook fish in sous vide in **52** °C / **125** °F bath to core temperature of **51** °C / **123** °F, about 20 min.

While fish is steaming:

Sauté vegetables in oil in wok until just cooked through and still crisp, about 2½ min.

Toss green mango with remaining salad elements.

Arrange portion of steamed fish on each plate, and top with sautéed vegetables.

Finish with green mango and cashew salad.

Garnish with crispy skin, and mint and cilantro leaves.

CRISPY SNAPPER SKIN

Yields 50 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Snapper skin	40 g	100%	① Vacuum seal, and cook sous vide in 85 °C / 185 °F bath for 3 h, then cool.
Egg whites	40 g	100%	② Blend until completely incorporated.
Maltodextrin DE 19	20 g	50%	③ Brush egg white mixture gently onto both sides of cooled skin.
Salt	as needed		④ Season brushed skin.
			⑤ Dehydrate at 50 °C / 122 °F in dehydrator or oven until crisp, about 5 h.
			⑥ Store in airtight container in cool, dry place.

MALAYSIAN AROMATIC OIL

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Grapeseed oil	350 g	100%	① Combine, and simmer together until oil is deep red and heavily saturated with aromatics, about 45 min.
Tomatoes, peeled and seeded	140 g	40%	② Cool.
Red shallots, thinly sliced	75 g	21.5%	③ Vacuum seal.
Sweet onions, sliced	65 g	19%	④ Refrigerate for 12 h to finish infusion.
Sichuan chilies, seeded and crushed	40 g	11.5%	⑤ Strain through fine sieve.
Garlic, pounded to paste	10 g	3%	⑥ Reserve for cooking wok-fried vegetables.
Shrimp paste (belacan)	10 g	3%	
Ginger, grated	7.5 g	2%	
Red bird's-eye chili, thinly sliced	2.5 g	0.7%	

FERMENTED SHRIMP SHEETS INSPIRED BY WYLIE DUFRESNE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Raw shrimp, ground	200 g	100%	① Puree in food processor until smooth.
Coconut milk	100 g	50%	② Pass through fine sieve.
Shrimp paste (belacan)	15 g	7.5%	③ Spread on silicone mat in layer 1 mm / 1/16 in thick.
Activa TI (or Activa RM)	6 g	3%	④ Cover, and steam in 55 °C / 131 °F combi oven for 4 min covered.
Salt	1.25 g	0.65%	⑤ Refrigerate for 1 h to set.
			⑥ Steam at 100 °C / 212 °F for 1 min, or cook sous vide at same temperature and time.
			⑦ Cool and refrigerate.

Heating the shrimp sheets to 55 °C / 131 °F increases the activity of the enzymes in Activa that cross-link the proteins in the puree.

WOK-FRIED MALAYSIAN VEGETABLES

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Bamboo shoots, thinly sliced	60 g	100%	① Measure and reserve individually, refrigerated.
Young lotus root, thinly sliced	50 g	83%	
Fermented prawn sheets, from above, julienne	40 g	67%	
Garlic chives, diced	30 g	50%	
Malaysian aromatic oil, from above	25 g	42%	
Savoy cabbage, chiffonade	25 g	42%	
Bean sprouts, trimmed	20 g	33%	

SOUS VIDE SNAPPER

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sambal badjak (store-bought)	70 g	28%	① Combine. ② Pass through fine sieve, and reserve.
Kejap manis (store-bought)	15 g	6%	
Shaoxing wine	10 g	4%	
Snapper, filleted and skinned	250 g	100%	③ Cut snapper into four 60 g portions.
Salt	to taste		④ Brush sieved mixture in layer 1 mm / 1/16 in, onto snapper portions. ⑤ Season. ⑥ Refrigerate until needed.

GREEN MANGO AND CASHEW SALAD

Yields 256 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Green mango, fine julienne	100 g	100%	① Measure and reserve individually.
Cashews, roasted	30 g	30%	
Mint leaves, torn	8 g	8%	
Cilantro stems and leaves, thinly sliced	4 g	4%	
Coconut water (fresh or canned)	60 g	60%	② Blend until smooth. ③ Refrigerate.
Fish sauce	40 g	40%	
Distilled vinegar	19 g	19%	
Lime juice	13 g	13%	
Sugar	8 g	8%	
Salt	1 g	1%	
Xanthan gum	0.28 g	0.28% *(0.2%)**	

**(% total weight of six preceding ingredients)*

BLACK COD "FRÉDY GIRARDET"

Condrieu distillate, purple artichoke confit, fresh blossom salad

Frédy Girardet developed one of coolest techniques for cooking fish—literally. He placed the fish fillet skin side up in a pan, filled the pan with enough wine to cover the meat but not the skin, then broiled the fish (for more insight on this process, see The Girardet Method, page 2·24).

When this technique is used, the fish skin absorbs the radiant heat of the broiler slowly at first, when the skin is silver and shiny, then more quickly as the skin darkens. Normally, broiling would easily overcook the fish. But because the wine evaporates, it stays cool. The skin crisps, but the wine poaches the fish at a moderate temperature: you get the best of both worlds.

Girardet would have used a great wine like the fantastic Rhône Condrieu—perhaps a mineral and bracing vintage by Chapoutier, or one fruity and smelling of summer, by Georges Vernay. When served, the cod has that subtle, hard-to-place aroma you often find in a great Condrieu.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment*
OPTIONAL EQUIPMENT:	*vacuum reduction equipment*
TIME REQUIRED:	*2¼ h overall, including 1½ h preparation and 25 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Condrieu Butter	15 min	*2 h**	5 min	340 g
Artichoke Confit	10 min	*1½ h**	8 min	150 g
Fricassee of Fava Beans and Lychees	10 min		3 min	150 g
Apricot and Jasmine Puree	10 min			250 g
Blossom Salad	15 min		1 min	125 g
Sous Vide Black Cod	5 min	*1 h**	20 min	four portions, 125 g each

**(unattended times)*

ASSEMBLY:

Place fish portions into shallow pan.
Pour wine into pan to submerge fish, but leave its skin exposed above wine's surface.
Place under hot broiler, and cook until wine reaches 55 °C / 131 °F and skin has darkened and crisped, about 6–10 min.
Remove pan from under broiler, and wait for core temperature of fish to reach 52 °C / 125 °F, about 5 min.
Remove fish from pan, and rest for 5 min at room temperature.

While fish is cooking:
Warm Condrieu butter base, and emulsify in cold butter.
Season with vinegar, essential oils, and salt.
Keep warm in open container held in 53 °C / 127 °F bath.
Warm artichoke confit in 53 °C / 127 °F water bath for 8 min.

While fish is resting:
Sauté fava beans and romaine in butter until just warmed through, about 2 min.
Toss in lychees, and heat until just warmed through, about 1 min.
Season with salt.
Cut raw artichokes into slices 1 mm / 1/32 in thick with mandolin.
Toss with remaining elements of blossom salad. Season to taste.
Arrange fish on plates.
Garnish each plate with spoonful of apricot and jasmine puree.
Finish with artichoke slices and fava bean and lychee fricassée.
Serve Condrieu butter and blossom salad on side.

Alternatively, cook black cod portions sous vide at 53 °C / 127 °F to a core temperature of 52 °C / 126 °F, about 25 min.

BLOSSOM SALAD

Yields 125 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Baby artichokes, trimmed of tough leaves	60 g	100%	① To serve, cut raw artichokes into slices 1 mm / 1/32 in thick with mandolin.
Apricots, julienne	48 g	80%	② Toss with remaining ingredients.
Organic rose petals	8 g	13%	③ Season.
Extra-virgin olive oil	5 g	8%	
Organic pansies	4 g	7%	
Wild wood violets (lamb's lettuce can be substituted)	4 g	7%	
Lime juice	to taste		
Salt	to taste		

Organic roses can be hard to find. Replace with edible blossoms that can often be found in good supermarkets in the fresh herb section.

CONDRIEU BUTTER

Yields 340 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Condrieu wine	750 g	500%	① Vacuum reduce to 150 g, and reserve.
Shallots, thinly sliced	60 g	40%	② Sauté until tender, about 10 min.
Clarified unsalted butter	50 g	33%	
Lychee juice (fresh)	100 g	67%	③ Deglaze shallots.
			④ Remove from heat.
			⑤ Drain.
			⑥ Cool completely.
Condrieu reduction, from above	150 g	100%	⑦ Whisk into shallots.
			⑧ Vacuum seal and refrigerate.
Unsalted butter, cold and cubed	75 g	50%	⑨ Measure and reserve individually.
Osmanthus vinegar	15 g	10%	
Orange blossom essential oil	0.05 g	0.03%	
Rose essential oil	0.05 g	0.03%	
Salt	to taste		

Vacuum reduction is our favorite method for reducing Condrieu wine to preserve its delicate floral tones. For a step-by-step procedure in this and other suitable reduction methods, see page 2·379.

Osmanthus vinegar is a semisweet vinegar available from most Asian markets. It is made from osmanthus blossoms and has a pronounced aroma of fresh apricots. If unavailable, you can substitute other semisweet vinegars, such as Muscat or white balsamic.

ARTICHOKE CONFIT

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	500 g	333%	① Vacuum seal together.
Purple artichoke, trimmed	150 g	100%	② Cook sous vide in 85 °C / 185 °F bath for 1½ h.
Unsalted butter	25 g	16.7%	③ Remove from bag, and cool.
Lime juice	15 g	10%	④ Refrigerate.
Bay leaf	0.2 g	0.13%	
Salt	to taste		

FRICASSEE OF FAVA BEANS AND LYCHEES

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Fava beans, shelled	50 g	62.5%	① To serve, sauté together in butter until just warmed through, about 2 min.
Romaine lettuce heart, julienne	10 g	12.5%	
Unsalted butter	2 g	2.5%	
Lychees (fresh or canned), peeled if fresh	80 g	100%	② Toss in lychees, and heat until just warmed through, about 1 min.
Salt	to taste		③ Season.

APRICOT AND JASMINE PUREE

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Unripe apricot juice, fresh	315 g	100%	① Blend together to fine puree.
Dried apricots, chopped	100 g	32%	
Xanthan gum	0.5 g	0.15% *(0.11%)**	
Osmanthus vinegar	25 g	8%	② Add to apricot puree.
			③ Refrigerate.
Jasmine essential oil	0.1 g (one drop)	0.03%	

**(% total weight of all other ingredients)*

BLACK COD

Yields 500 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Black cod fillet	500 g	100%	① Cut fillet into four equal portions.
Salt	7 g	1.4%	② Combine with salt and sugar.
Sugar	3 g	0.6%	③ Vacuum seal portions individually, and refrigerate for 1 h to cure.
			④ Remove cured fish from bags.
			⑤ Rinse and pat dry.
			⑥ Vacuum seal and refrigerate.

HAWAIIAN POKE

Escolar and tuna checkerboard, ogo, candlenut, passion fruit

You'll find poke on the menu of many high-end Hawaiian restaurants today, but the dish has humble origins. Polynesian fishermen would catch reef fish, score them, and eat them with a little salt, seaweed, and roasted candlenut relish. Poke became a blue-collar, workaday dinner, often chased with a beer.

In the 1900s, the flourishing sugarcane industry in Hawaii attracted a flood of immigrants—many of them from Japan and China—and the influx led to hundreds of variations on the traditional poke theme. These dishes gained even wider attention in the 1980s, as Americans developed increasing interest in regional cuisines. Today, yellowfin tuna (ahi) and a crunchy seaweed (ogo) are popular ingredients. This recipe imagines yellowfin tuna in a checkerboard pattern with rich white escolar alongside Maui sweet onion salsa and passion fruit for balance.

YIELD: *four portions*
OPTIONAL EQUIPMENT: *Pacojet*
TIME REQUIRED: *12 h overall, including 50 min preparation and 5 min to finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Tuna and Escolar Checkerboard	30 min	*12 h**	1 min	400 g
Passion Fruit Granita	5 min	*2 h**	1 min	80 g
Roasted Candlenuts		8 min		50 g
Marinated Ogo	5 min		2 min	100 g
Sweet Onion Salsa	10 min			160 g
GARNISH				
Jicama, small dice				15 g
Cilantro leaves				12
Passion fruit seeds				10 g
Toasted sesame oil				8 g

**(unattended times)*

ASSEMBLY:

Marinate ogo in reserved ingredients for 2 min.
Season onion salsa with white soy sauce and rice vinegar.
Pacotize passion fruit granita once. If not using Pacojet, break up granita with fork just before serving.
Cut fish checkerboard into slices 3 mm / ⅛ in thick.
Arrange three slices on each chilled plate, and season with salt.
Top with granita, marinated ogo, and salsa.
Garnish with jicama, cilantro leaves, and passion fruit seeds.
Grate roasted candlenuts over fish slices, then drizzle with toasted sesame oil.

Escolar can be elusive. Sometimes labeled "butterfish," it has masqueraded as white tuna or sea bass, and is often confused with oilfish. It can have an oil content as high as 25%, which makes it deliciously rich. But there is one problem: it contains waxy esters that sometimes cause gastrointestinal distress. Grilling the fish renders out some of the offending compounds with the oil, but we think it is a crime to cook escolar above body temperature. Just don't eat more than 100 grams.

TUNA AND ESCOLAR CHECKERBOARD

Yields 425 g

Why albacore or yellowfin tuna instead of bluefin? This recipe does not need the richness of bluefin; albacore and yellowfin work best. Moreover, the bluefin tuna population has been decimated by 97% since the early 1960s, when large-scale commercial fishing began. Bluefin tuna, prized for sashimi, fetched nearly $350 a pound at Tokyo's Tsukiji market in January 2010. International efforts to ban bluefin fishing failed as recently as March 2010.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Escolar	200 g	100%	① Cut into strips 2.5 cm by 2.5 cm by 10 cm / 1 in by 1 in by 4 in.
Tuna (yellowfin or albacore)	200 g	100%	② Lay large piece of plastic wrap across work surface.
Water	25 g	12.5%	③ Combine to form slurry.
Activa RM	10 g	5%	④ Brush slurry over fish strips.
			⑤ Align and stack alternating red and white strips quickly to form five-strip-wide, five-strip-high checkerboard on plastic wrap.
			⑥ Wrap checkerboard tightly in plastic wrap, and vacuum seal to press strips firmly together.
			⑦ Refrigerate fish for at least 4 h to ensure bonding.
Salt	to taste		⑧ Reserve.

For more on using Activa to make patterns such as this, including a step-by-step procedure, see page 3:251.

ROASTED CANDLENUTS

Yields 50 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Candlenuts	50 g	100%	① Toss nuts in oil.
Neutral oil	15 g	30%	② Roast nuts in 175 °C / 350 °F oven until golden brown, about 8 min.
			③ Pat dry of excess oil.
Salt	0.5 g	1%	④ Season, and reserve in cool, dry place.

Candlenuts, or *kukui* nuts, have such a high oil content—10% to 15%—that they can be used as candles. Ancient Hawaiians would string the large, round nuts along the rib of a palm frond, and children would be instructed to light them one at a time. The nuts are always cooked before eating, as they are mildly toxic when raw. Macadamia nuts or Brazil nuts are possible substitutions.

MARINATED OGO

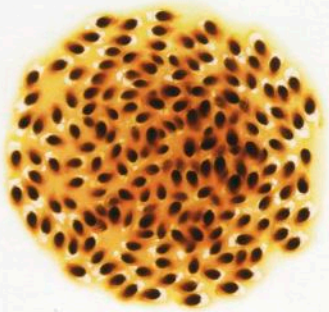
Yields 25 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Ogo seaweed (fresh)	50 g	100%	① Refrigerate.
Lime juice	2 g	4%	② Measure and reserve individually.
Mirin	2 g	4%	
Tamari soy sauce	2 g	4%	
Toasted sesame oil	2 g	4%	

SWEET ONION SALSA

Yields 40 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, brunoise	25 g	100%	① Combine.
Jalapeño chili, brunoise	2.5 g	10%	② Refrigerate.
Young ginger, brunoise	2.5 g	10%	
White soy sauce	5 g	20%	③ Measure and reserve individually.
Rice vinegar	3.5 g	14%	



PASSION FRUIT GRANITA

Yields 180 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Passion fruit juice	150 g	100%	① Combine.
Sugar	20 g	13.5%	② Transfer to Pacojet beaker, and freeze. Alternatively, freeze mixture in container, and break it up with fork into flakes periodically as it freezes. Reserve frozen.
Lime juice	10 g	6.5%	
Salt	1.5 g	1%	

SHELLFISH

SHRIMP COCKTAIL

Passion fruit, brown butter, braised beet, pressure-cooked sesame seeds

The shrimp cocktail was a standard-bearer for 1960s culinary sophistication. But overexposure and the passage of time have turned the dish into a culinary joke, exiling it from the tables of serious restaurants. Today, this once classy first course is seen mainly on country club menus or in the refrigerated display cases of the diners that dot America's interstate highways.

It is easy to forget that the shrimp cocktail can be spectacularly good. The sweetness of impeccably fresh shrimp or spot prawns served ice-cold with a sharp and tangy sauce is an unbeatable combination. A mixture of ketchup and horseradish is acceptable, but there's no good reason to reproduce that tired accompaniment. We like the exotic flavor of passion fruit in place of ketchup. And the sesame seeds in this recipe are an unorthodox addition, both for their crunch and for their earthy aroma, which delivers a nice counterpoint to the sulfurous pungency of passion fruit. This is a decidedly different rendition of an old favorite, but we think it captures the essence of what was exciting about this dish when it graced the best tables.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, pressure cooker*
OPTIONAL EQUIPMENT:	*combi oven or water-vapor oven*
TIME REQUIRED:	*3 h overall, including 25 min preparation and 5 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Passion Fruit Brown Butter Fluid Gel	5 min	10 min		60 g
Passion Fruit Chewy Leather see page 3·366	5 min	*8 h**		40 g
Passion Fruit White Soy Sauce Vinaigrette	5 min			75 g
Sous Vide Baby Beet	10 min	*3 h**		180 g
Pressure-cooked Sesame Seeds see page 3·303	2 min	*1½ h**		80 g
Steamed Live Spot Prawn	2 min	3 min	3 min	200 g
GARNISH				
Horseradish, shaved				20 g
Mint leaves				12 small
Lime zest, julienne				4 g

**(unattended times)*

ASSEMBLY:

Marinate prawns in passion fruit vinaigrette for 3 min.

While prawns are marinating:

Garnish each chilled plate with dots of passion fruit fluid gel, baby beets, and small mounds of pressure-cooked sesame seeds.

To finish:

Arrange marinated prawns on plates.

Garnish with horseradish, mint leaves, passion fruit leather, and lime zest.

PASSION FRUIT BROWN BUTTER FLUID GEL

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Passion fruit juice	250 g	100%	① Combine, and bring to a boil.
Agar	1.35 g	0.54% (*0.45%*)*	② Pour liquid into beaker set in ice-water bath.
			③ Blend with immersion blender as gel sets, until cooled and fluid.
			④ Blend into fluid gel.
			⑤ Strain.
Horseradish, grated	7.5 g	3%	⑥ Blend into fluid gel.
			⑦ Adjust to taste.
Brown butter, melted	50 g	20%	⑧ Whisk in.
Malic acid	4.5 g	1.8%	⑨ Season.
Salt	to taste		

(% of total weight of all other ingredients*)

For more on making brown butter, see page 4·213.

The earthy aroma of beet comes from a compound called geosmin. We think that it complements the bright acidity and pungency of passion fruit.

PASSION FRUIT–WHITE SOY SAUCE VINAIGRETTE

Yields 70 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Passion fruit juice	55 g	100%	① Mix together until malic acid is fully dissolved.
White soy sauce	10.5 g	19%	② Reserve.
Lime juice	7 g	13%	
Jalapeño, brunoise	3 g	5.5%	
Malic acid	1 g	1.8%	

SOUS VIDE BABY BEET

Yields 375 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Baby beets, trimmed but not peeled	250 g	100%	① Vacuum seal together.
Extra-virgin olive oil	75 g	30%	② Cook sous vide in 88 °C / 190 °F bath for 1 h.
Water	50 g	20%	③ Remove from bag, reserving juices, and rub off beet skins with clean kitchen towel.
Salt	3.5 g	1.4%	④ Vacuum seal beets and juices.
			⑤ Refrigerate for at least 2 h before serving.

STEAMED LIVE SPOT PRAWN

Yields 720 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Live spot prawns	720 g (about 12 prawns)	100%	① Steam at 90 °C / 195 °F with 100% humidity for 3 min.
			② Alternatively, vacuum seal in single even layer. Cook sous vide in 45 °C / 114 °F bath for 20 min.
			③ Shock in ice-water bath.
			④ Peel and refrigerate.

Pressure cooking makes it possible to turn tough seeds tender. For more on this technique, see page 3·298.

LOBSTER AMÉRICAINE

Carotene butter, coconut, mandarin, lobster mushroom

This lobster dish has dubious origins. A French chef is said to have worked for a year, in 1858, at a Chicago restaurant called Café Américaine. A few years later in Paris, he cooked this dish for Americans who were in a rush, and named it for them. Or so the story goes. A French dish called American? Unacceptable, some purists said, and they rechristened the dish *Homard à l'Armoricaine*—claiming it was from Brittany (formerly known as Armorica). Or so *that* story goes. (But writers since have questioned this, noting that the olive oil, garlic, and tomatoes in the dish are rare in the cuisine of Brittany.) With so many variations in ingredients and technique, the definition of this dish is just as nebulous as its origin.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, pressure cooker*
OPTIONAL EQUIPMENT:	*espresso milk steamer, vacuum reduction equipment, freeze dryer*
TIME REQUIRED:	*25 h overall, including 2 h preparation and 15 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Salted, Freeze-dried Lobster Tail optional, see page 2·454	20 min	*24 h**		10 g
Enzyme-Peeled Mandarin Segments see page 3·357	5 min	*12 h**		120 g
Shellfish Stock	10 min	1¾ h		600 g
Carotene Butter optional, see page 2·365	15 min	1 h		145 g
Lobster Mushroom Confit	10 min	*40 min**	10 min	200 g
Glazed Carrot	4 min	*40 min**		100 g
Poached Lobster Tail	2 min		7 min	240 g
Coconut-Lobster Emulsion		15 min	1 min	90 g
GARNISH				
Kinome branches				12 small
Coconut cream powder				10 g

**(unattended times)*

ASSEMBLY:

Cook lobster tails sous vide in **52** °C / **125** °F bath to core temperature of **51** °C / **123** °F about 10 min.

While lobster tails are cooking:

Reheat mushroom confit at **70** °C / **158** °F for 10 min.

Reheat carrots on stovetop until cooking juices thicken slightly and carrots are warm, about 2 min.

Rest cooked lobster for 2 min, then sear for 10 s on each side to tighten flesh.

Cut each tail into three equal medallions, and season.

Foam coconut-lobster emulsion with steam wand of espresso machine (see page 4-391), or heat while whipping with handheld milk frother until dense, wet foam forms.

Arrange three lobster medallions on each plate, and place one carrot next to each medallion.

Garnish with three mandarin segments, thin slices of mushroom confit, and foam, then finish plate with kinome branches and light dusting of coconut cream powder.

Grate freeze-dried lobster tail on medallions to season (optional).

For other time-temperature combinations that work well when cooking lobster, see page 3-103.

SHELLFISH STOCK

Yields 800 g

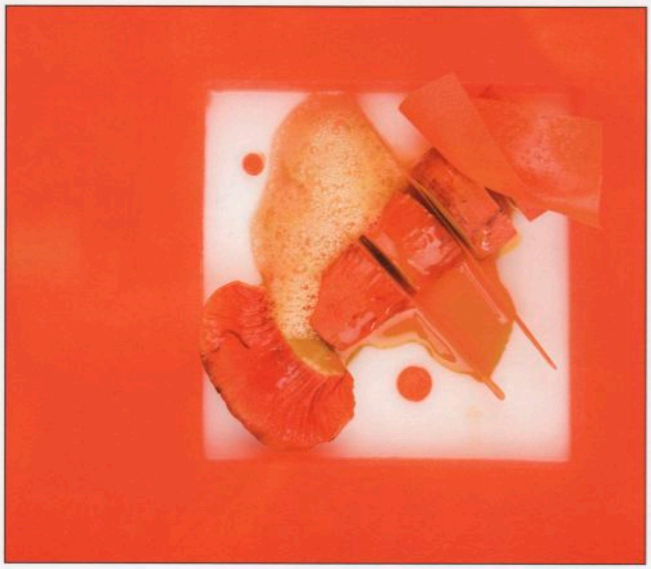
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Chicken wings, chopped	500 g	33%	① Roast together at 230 °C / 450 °F until uniformly golden brown, about 25 min, and reserve.
Ground pork	500 g	33%	
Dungeness crab (whole)	1.5 kg (about three medium)	100%	② Crush crab shells and meat into smaller pieces. ③ Fry in bottom of pressure cooker in oils until golden, about 8 min.
Grapeseed oil	150 g	10%	④ Remove crab pieces from oil; reserve crab oil.
Coconut oil	25 g	1.7%	
Leeks, thinly sliced	250 g	17%	⑤ Fry prepared vegetables together in pressure cooker in crab oil until golden. ⑥ Add tomato paste. ⑦ Continue frying until mixture is amber and cooked tomato flavor develops, about 3 min.
Carrots, peeled and thinly sliced	200 g	13.5%	
Green onions, thinly sliced	150 g	10%	
Shallots, thinly sliced	150 g	10%	
Tomato paste	50 g	3.5%	
Water	1.5 kg	100%	⑧ Deglaze pressure cooker.
Carrot juice	100 g (from 250 g of carrots)	7%	
Shaoxing wine	82.5 g	5.5%	
Star anise	1.8 g	0.12%	⑨ Combine; place in sachet.
Black peppercorns	0.8 g	0.05%	⑩ Combine pork and chicken mixture, vegetable mixture, and crab pieces in pressure cooker.
Grains of paradise	0.6 g	0.04%	
Coriander seeds	0.4 g	0.03%	⑪ Add sachet, and pressure-cook at a gauge pressure of 1 bar / 15 psi for 1 h.
Cardamom pod	0.3 g	0.02%	⑫ Strain, and reserve for coconut-lobster emulsion.

GLAZED CARROT

Yields 120 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Young carrots (preferably Thumbelina), peeled	100 g	100%	① Vacuum seal together. ② Cook sous vide in 80 °C / 176 °F bath for 40 min. ③ Cool, remove carrots from bag, and reserve.
Carotene butter	20 g	20%	
Mandarin juice	48 g	48%	④ Vacuum-reduce (or reduce over heat) to glaze, about 7 min.
Valencia orange juice	45 g	45%	
Honey	5 g	5%	
Mandarin essential oil	0.1 g		⑤ Season glaze. ⑥ Cool. ⑦ Vacuum seal carrots with glaze, and refrigerate.
Salt	to taste		

For more on how to vacuum-reduce liquids, see page 2-382.



A vegetarian version of this dish (above left) uses only the rust-colored lobster mushrooms, which share the plate with the crustacean meat at above right. To prepare a vegan version, make carotene oil.

LOBSTER MUSHROOM CONFIT

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Lobster mushroom	200 g	100%	① Vacuum seal together.
Carotene butter (or unsalted butter)	100 g	50%	② Cook sous vide in 80 °C / 176 °F bath for 40 min.
			③ Refrigerate.
Salt	4 g	2%	

The term "lobster mushroom" does not refer to a mushroom but to *Hypomyces lactifluorum*, a parasitic fungus that turns any infected mushroom a lobster-like reddish orange.

POACHED LOBSTER TAIL

Yields 240 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Lobster tails	240 g (four tails)	100%	① Vacuum seal together.
Carotene butter or unsalted butter	100 g	42%	② Refrigerate.

see page 2·365

COCONUT-LOBSTER EMULSION

Yields 90 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shellfish stock, from above	600 g	100%	① Reduce to 90 g.
			② Cool.
Coconut cream powder (store-bought)	25 g	4.2%	③ Whisk into reduced stock.
White soy sauce	to taste		④ Season stock.
Locust bean gum	0.86 g	0.15% (*0.75%*)*	⑤ Mix into stock.
			⑥ Bring to a boil to hydrate and remove from heat.
Whey protein isolate	2.3 g	0.4% (*2%*)*	⑦ Whisk into stock until dissolved.
			⑧ Cool.
			⑨ Refrigerate.

(% of total weight of shellfish stock reduction and coconut cream powder*)

Locust bean gum gives body, while whey protein isolate aids in foaming. The combination of the two yields a velvety, dense foam.

THAI CRAB MIANG

Frozen pomelo, puffed crab, Makrud lime

Thailand is famous for its hawker food, homemade specialties sold from stalls, baskets, and even bikes throughout the country. Surprisingly, this street food is a relatively new phenomenon in Thailand, first appearing in the 1960s, with the arrival of enterprising Chinese immigrants who brought both the concept and many of the flavors.

One savory snack sold on the streets of Bangkok is *miang kham*, which is more of an idea than a specific dish. Bits of a flavorful food, such as dried shrimp or cured pork, are combined with such spicy and fragrant garnishes as ginger, chili, and lime on a betel leaf. The heady mix is dressed with palm syrup and fish sauce, and then the leaf is wrapped around the filling and eaten in a single bite.

Miang kham can also be enjoyed in, of all places, a hotel restaurant in London's Belgravia district. A version sampled there—dried shrimp tossed with flaked young coconut and pomelo—was shockingly good. It was prepared by Australian chef David Thompson at his restaurant Nahm—the first Thai eatery to receive a Michelin star.

Chef Thompson's *miang kham* was the inspiration for this version, which features a stateside slant that plays on the American popularity of chips and dip. Serve this with crisp crab crackers. In place of dried shrimp, we use sweet Dungeness crab meat from local waters. The resulting complexity of flavors in this mélange will transport you to Thailand ... by way of London.

YIELD: *four portions*
SPECIAL EQUIPMENT: *dehydrator*
OPTIONAL EQUIPMENT: *meat slicer, liquid nitrogen*
TIME REQUIRED: *8 h overall, including 1¼ h preparation and 15 min to assemble*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Puffed Crab Crackers	20 min	*7½ h**	5–10 s	125 g
Tamarind Paste see page 99	8 min	*30 min**		35 g
Shellfish Stock see page 2·297	25 min	*1½ h**		400 g
Crab Oil	5 min	1 h	15 min	400 g
Miang Paste	10 min	2 min		14 g
Miang Syrup		5 min		14 g
Frozen Pomelo Cells	5 min		3 min	80 g
Marinated Crab Salad	10 min		1 min	325 g
GARNISH				
Betel leaves				12

**(unattended times)*

ASSEMBLY:

Preheat frying oil for crab to **190** °C / **375** °F.

Pour liquid nitrogen over pomelo segments until frozen, then break apart juice cells with spoon (see page 2·462). Thaw for 20 min at room temperature.

Prepare crab salad by dressing crab with pomelo, miang paste, miang syrup, and other ingredients.

Deep-fry each crab cracker until puffed, 5–10 s. Pat dry.

Garnish each plate with three betel leaves.

Place dressed crab salad on leaves, and serve with crackers.

PUFFED CRAB CRACKERS

Yields 125 g

Store-bought steamed crabmeat works fine in this recipe. If you would rather start with fresh-picked crab, see the time-temperature table for cooking shellfish sous vide on page 3·102.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shellfish stock see page 2·297	400 g	100%	① Reduce to 55 g. ② Cool.
Tapioca starch	150 g	37.5%	③ Whisk together with reduced stock to form dough.
Warm water	55 g	14%	
Raw crabmeat or prawn meat, ground	55 g	14%	④ Blend with dough in food processor.
Salt	7 g	2%	⑤ Spread paste on plastic wrap, and roll into cylinder 5 cm / 2 in. in diameter. ⑥ Steam for 1 h 10 min. ⑦ Cool, then refrigerate until rigid, at least 5 h. ⑧ Cut into slices 1 mm / 1/32 in thick, using meat slicer if available. ⑨ Dehydrate slices at 50 °C / 120 °F until brittle, about 1 h. ⑩ Store in airtight container at room temperature.
Frying oil	as needed		⑪ Reserve.

CRAB OIL

Yields 400 g

The shell and liver of all crustaceans are highly flavorful. Here, the shell and liver of the crab infuse the frying oil with both the sweet, delicious essence and the bright orange pigment of the shellfish.

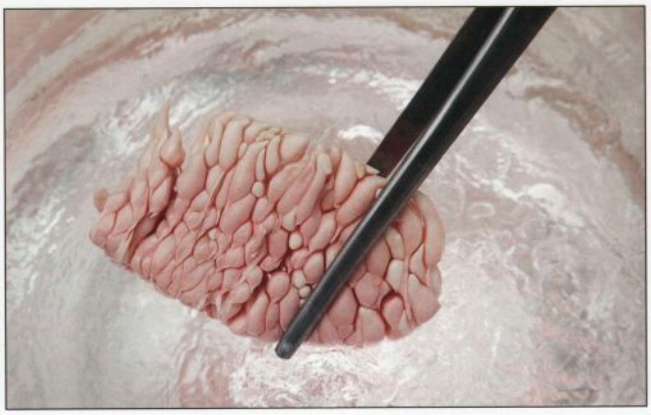
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Frying oil	400 g	200%	① Deep-fry in 175 °C / 350 °F oil for 1 h.
Crab shell and liver	200 g	100%	② Strain through fine sieve. ③ Cool, then reserve in dry place.

MIANG PASTE

Yields 185 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Galangal, sliced 1 cm / 3/8 in thick	20 g	27%	① Fry in dry pan for 2 min on each side.
Coconut flakes, roasted	75 g	100%	② Mix all ingredients with galangal.
Peanuts, roasted	40 g	53%	③ Blend mixture to paste using mortar and pestle or food processor.
Lemongrass	30 g	40%	④ Refrigerate.
Thai chili (fresh)	21 g	28%	
Fermented shrimp paste (gapi), roasted	8 g	11%	
Makrud lime leaves	1 g	1.5%	
Palm oil	1 g	1.5%	

Liquid nitrogen freezes pomelo segments into a brittle and glassy state. It is easy to then separate the juice sacs in the fruit.



MIANG SYRUP

Yields 220 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Palm sugar	75 g	136%	① Simmer together until sugar dissolves.
Fish sauce	55 g	100%	② Adjust seasoning to taste.
Water	55 g	100%	
Tamarind paste see page 99	35 g	64%	

FROZEN POMELO CELLS

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pomelo, peeled	100 g	100%	① Measure and reserve individually.
Liquid nitrogen	as needed		

The juice sacs can be separated manually without liquid nitrogen, but it is tedious work.

MARINATED CRAB SALAD

Yields 325 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Steamed crabmeat	200 g	100%	① Measure and reserve individually.
Dungeness pomelo cells, from above	80 g	40%	
Miang paste, from above	14 g	7%	
Miang syrup, from above	14 g	7%	
Coriander stem, minced	6 g	3%	
Peanuts, roasted	6 g	3%	
Red shallot, minced	4 g	2%	
Young ginger, minced	2 g	1%	
Lime zest, small dice	1 g	0.5%	
Lime juice	to taste		
Salt	to taste		

The pigment from the crab shell is soluble in fat and imparts a beautiful red hue to the oil.

PULPO A LA GALLEGA

Chorizo powder, baked potato, black olive

Culinary traditions abound with stories about how to make octopus tender. One popular suggestion is to soak it with wine corks, allegedly enzyme-rich. Don't bother; this has proven to be a myth. Octopus is tough because of its uniquely designed constrictor muscle (see How Muscles Work, page 3·6). Past a certain point of cooking, the collagen shrinks and greatly toughens the meat. So really you have two choices. One is to pound the octopus to tenderize it, sear it so that it is still raw inside, then enjoy its natural chewiness. A second approach is to cook it long and hot enough, with enough moisture, to melt the collagen into gelatin. Sous vide is the perfect technique for doing just that and thus is ideal for cooking *pulpo a la gallega*. Our version is inspired by the classic tapas dish served on hot evenings in Spain.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, dehydrator, whipping siphon, griddle*
TIME REQUIRED: *24 h overall (73 h for fresh chorizo), including 4 h preparation and 45 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Cured Chorizo **optional, see page 3·244**	35 min	*3 d**		500 g
Black Olive Oil		*24 h**		40 g
Chorizo Crisps	15 min	*5 h**		40 g (eight slices, 5 g each)
Sous Vide Octopus	10 min	*4 h**	15 min	500 g
Frozen Chorizo Powder		*2 h**		25 g
Hot Smoked Potato **see page 3·362**	5 min	1½ h		200 g
Baked Potato Foam **see page 4·281**	10 min	1 h	15 min	120 g
Smoked Potato Confit	5 min		15 min	250 g
GARNISH				
Pimentón dulce				5 g
Tarragon leaves				12

**(unattended times)*

Pulpo a la gallega hails from Galicia, Spain. There, it is called polbo á feira, or "market-fair-style octopus," because it was often served at such fairs in the hinterlands.

ASSEMBLY:

Warm peeled octopus in **60** °C / **140** °F bath for 15 min.
Fill siphon with baked potato foam. Heat siphon in **70** °C / **158** °F bath for about 15 min. Charge with two nitrous oxide cartridges, then hold in hot water bath.
Add smoked potatoes to same bath, and reheat for 15 min.
Brush reserved oil onto skin of unpeeled octopus.
Grill unpeeled octopus on griddle or over coals until deeply charred, about 2 min. Season with salt.

While octopus is grilling:
Sear potato confit until golden.
Arrange one peeled and one unpeeled octopus leg on each plate with potato confit and chorizo crisps.
Grate frozen chorizo with Microplane grater over octopus.
Garnish each plate with drizzle of black oil, dusting of pimentón dulce, and tarragon leaves.
Dispense baked potato foam on side.

SOUS VIDE OCTOPUS

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Octopus legs	500 g (eight legs)	100%	① Blanch for 30 s to remove slime. ② Cool in ice-water bath. ③ Vacuum seal individually. ④ Cook sous vide in 85 °C / 185 °F bath for 4 h. ⑤ Cool in bag, in ice-water bath. ⑥ Peel skin off four octopus legs.
Extra-virgin olive oil	50 g	10%	⑦ Vacuum seal peeled octopus legs with 25 g of oil. ⑧ Vacuum seal unpeeled legs. ⑨ Refrigerate both bags. ⑩ Reserve remaining 25 g of oil.
Salt	4.5 g	1%	⑪ Reserve.

CHORIZO CRISPS

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cured chorizo, optional see page 3-244	250 g	100%	① Slice lengthwise 1 mm / 1/16 in thick.
N-Zorbit M (National Starch brand)	50 g	20%	② Dust evenly with N-Zorbit M; shake off excess. ③ Dehydrate at 45 °C / 113 °F until dry and crisp, about 5 h. ④ Store in cool, dry place.

FROZEN CHORIZO POWDER

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cured chorizo optional, see page 3-244	250 g	100%	① Freeze completely solid, about 2 h in commercial freezer or 5 min with liquid nitrogen. ② Reserve frozen.

High-quality, store-bought chorizo can be substituted for home-cured chorizo.

BLACK OLIVE OIL

ADAPTED FROM MICHEL BRAS

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Black olives, pitted	150 g	100%	① Dehydrate at 60 °C / 140 °F for 12 h until brittle.
Extra-virgin olive oil	125 g	83%	② Blend olives and oil for 15 min until oil is black.
			③ Vacuum seal mixture.
			④ Macerate at room temperature for 12 h.
			⑤ Strain through fine sieve.
			⑥ Reserve.

SMOKED POTATO CONFIT

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yukon Gold potatoes, hot-smoked see page 3·362	200 g (four potatoes)	100%	① Cut out 3 cm by 6 cm / 1¼ in by 2¼ in cylinders using ring cutter.
Extra-virgin olive oil	50 g	50%	② Vacuum seal together.
Salt	1.5 g	1.5%	③ Refrigerate until needed.

SHELLFISH OMAKASE

Crustacean jewels of the Pacific Northwest

In Japan, *omakase* means "I leave it up to you"—chef's choice. It is a signal of trust and appreciation. The chef serves one beautifully presented dish after another, taking into consideration the season, the ingredients available, and the diner's reactions. If the chef already knows a loyal customer's likes and dislikes, *omakase* can be a highly personal experience. *Washoku* is the traditional Japanese "way of food." It imbues each *omakase* meal with nutritional balance and aesthetic harmony, with five colors, five tastes, five senses, five methods of cooking, and five "outlooks" (including each diner's mind-set). But time recasts traditions, and Japanese restaurants now often use *omakase* to refer to a fixed-priced tasting menu. The collection of preparations here is inspired by the incredible supply of fresh shellfish we enjoy in the Pacific Northwest. We leave it up to you to decide which of these you like best.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, carbonation equipment, shabu-shabu pot, blowtorch, dehydrator, whipping siphon*
OPTIONAL EQUIPMENT: *freeze dryer, bincho-tan grill, centrifuge, rotor-stator homogenizer*
TIME REQUIRED: *24 h overall, including 5 h preparation and 40 min to cook and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Soy Yuba see page 4·115	5 min	1 h		120 g
Sous Vide Ponzu see page 2·313	15 min	*1 wk**		80 g
Freeze-dried Scallop Powder see page 2·451	10 min	*24 h**		28 g
Hon Dashi see page 2·306	5 min	*1 h**		550 g
Scallop Mochi see page 4·308	10 min	*2 h**		60 g (four pieces, 15 g each)
Smoked White Soy Sauce see page 3·362		*24 h**		100 g
Razor Clam "Takoyaki," with Grey Mullet Bottarga, Sea Bean, Mutsu Apple	20 min	*2 h* and *45 min**	2 min	250 g (10 balls, 25 g each)
Shigoku Oyster with Fizzy Grapes and Fresh Wasabi	15 min	*12 h**	2 min	200 g
Marinated Geoduck, Young Ginger, Shiso	20 min	20 s	1 min	120 g
Spot Prawn and Lotus Root Tempura	35 min		10 min	240 g
Sea Urchin Tofu, Tokyo Negi, Sesame, Ponzu	10 min	*5 h**	1 min	100 g
Pen Shell Clam, Pluot, Myoga, Scallop Mochi	30 min		7 min	200 g
Bincho-tan-grilled Sea Cucumber, Maitake, Shisito Pepper	15 min		5 min	250 g
Abalone and Foie Gras Shabu-Shabu with Yuba and Enoki	15 min	*12 h**	8 min	500 g

**(unattended times)*

ASSEMBLY:

For razor clam "takoyaki":

Heat frying oil to **190** °C / **375** °F.

Deep-fry takoyaki balls until golden, about 1 min. Set in centers of small bowls.

Toss together apple and sea beans.

Season with lime juice and salt.

Garnish with shavings of bottarga.

For Shigoku oysters:

Remove carbonated grapes from siphon, and place 5½ pieces at bottom of each bowl.

Top each bowl with one shucked oyster.

Garnish with wasabi and miso powder.

Whip foam until frothy with handheld foaming wand.

Dress plate with oyster-juice foam.

For marinated geoduck:

Toss Japanese cucumber, scallion, and shiso leaves with young ginger, green chili, lime juice, and rice vinegar.

Adjust seasoning with usukuchi shoyu.

Arrange geoduck and salad on each plate.

Finish with smoked salt.

For spot prawn tempura:

Blend dry ingredients of tempura batter with cold sake, vodka, and malt syrup until well mixed.

Transfer to siphon, and two nitrous oxide cartridges.

Dispense batter into bowl.

Dip lotus root slices into batter to coat evenly.

Deep-fry spot prawns and lotus root slices in **190** °C / **375** °F oil until crisp and golden, about 2 min.

Arrange on plate, and serve with smoked white soy dipping sauce.

For sea urchin tofu:

Cut sea urchin tofu into 3 cm by 8 cm / 1¼ in by 3¼ in rectangles, and arrange on plate.

Toss negi with yuzu juice and toasted-sesame oil, and arrange on top of tofu.

Pour ponzu around tofu.

For pen shell clams:

Dust pen shell clams with scallop powder, and sear in oil over high heat for 1 min.

Season with salt, and allow to rest at room temperature.

Deep-fry scallop mochi in **190** °C / **375** °F oil until puffed, about 2 min.

Season with scallop powder.

Toss Pluot and myoga with small amount of seasoned Pluot juice.

Arrange pen shell clams and Pluot slices on each plate.

Garnish with scallop mochi.

Pour additional Pluot juice at table.

For bincho-tan sea cucumber:

Preheat bincho-tan charcoal in grill until it burns white-hot.

Brush sea cucumber, maitake mushrooms, and shisito peppers with oil, and sprinkle with Sansho pepper.

Grill until cooked through, about 5 min.

Arrange grilled foods on plate.

Season with flaky salt and yuzu kosho.

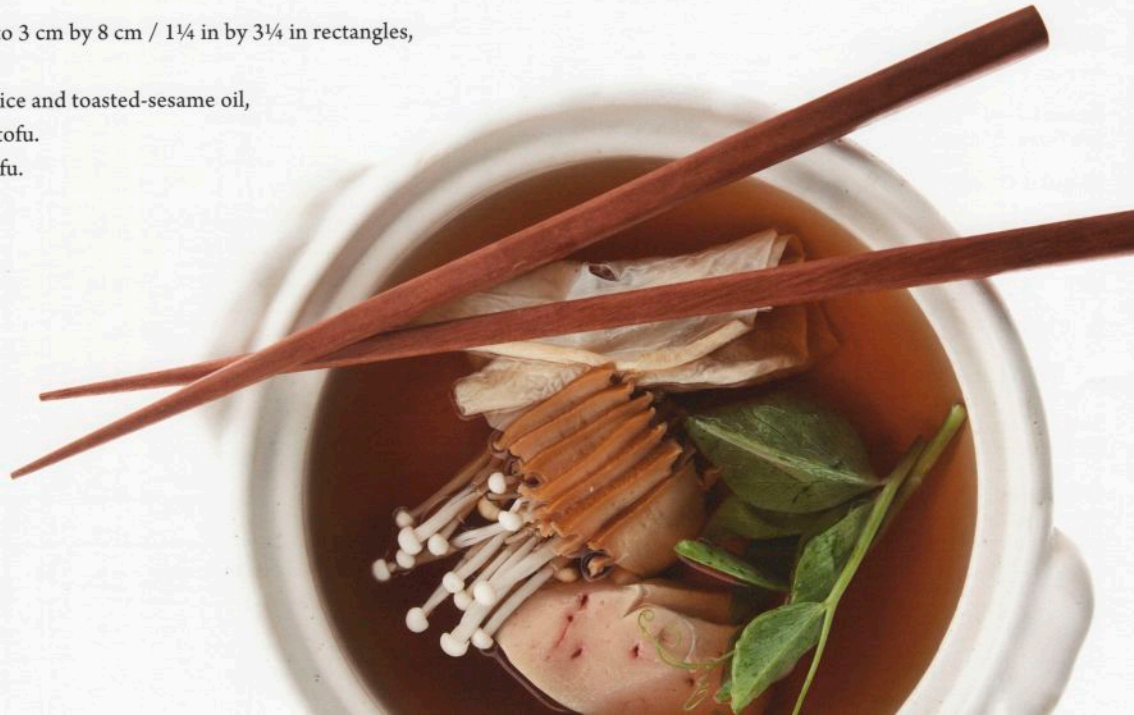
For abalone and foie gras shabu-shabu:

Slice abalone, and arrange with foie gras and vegetable garnishes in bowl.

Bring broth to boil, and maintain at simmer in shabu-shabu pot over portable gas or electric stove.

Warm tosazu (dipping sauce), and blend in foie gras fat to form loose emulsion.

Serve emulsion on side, and invite guests to dip raw ingredients into warm broth for desired doneness and then briefly into tosazu. Broth is shared among diners after raw ingredients have been eaten.



RAZOR CLAM "TAKOYAKI"

Yields 250 g (10 balls)

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Live razor clams	900 g	450%	① Vacuum seal together.
Ginger, thinly sliced	5 g	2.5%	② Steam at 100 °C / 212 °F for 6 min.
Scallions, thinly sliced	5 g	2.5%	③ Strain clam juice, and reserve 50 g.
Sake (dry)	30 g	15%	④ Shuck clams, reserving any additional juice.
			⑤ Mince clam meat, and reserve.
Tokyo negi (Japanese leek), finely minced	225 g	112.5%	⑥ Sweat until tender, about 3 min.
Unsalted butter, cubed	40 g	20%	
Heavy cream	150 g	75%	⑦ Add, and bring to a simmer.
Clam juice, from above	50 g	25%	⑧ Strain, and measure 200 g of clam cream.
			⑨ Refrigerate until cold.
Clam cream, from above	200 g	100%	⑩ Whisk into cold clam cream, and bring to simmer to hydrate.
Salt	4 g	2%	⑪ Puree with immersion blender over ice-water bath to form fluid gel.
Low acyl gellan (Gellan F, CP Kelco brand)	0.3 g	0.15%	⑫ Fold in reserved minced clam meat.
			⑬ Pipe mixture into spherical silicone molds 2 cm / ¾ in. in diameter.
Iota carrageenan	0.4 g	0.2%	⑭ Freeze until gel balls are hardened, at least 45 min.
Utra-Sperse 3 (National Starch brand)	1 g	0.5%	
Water, boiling	50 g	25%	⑮ Disperse methylcellulose into boiling water, blending constantly.
Methocel K100M (Dow brand)	0.25 g	0.125%	⑯ Cool and reserve.
Batter Bind S (National Starch brand)	50 g	25%	⑰ Dust over balls.
			⑱ Whip methylcellulose mixture into stiff foam.
			⑲ Dip dusted balls into foam to fully cover surface.
Panko, finely ground	50 g	25%	⑳ Roll coated balls in panko.
			㉑ Dip the breaded balls in the methylcellulose foam and panko once more.
			㉒ Refrigerate to firm crust, at least 2 h.
Mutsu apple, batons	20 g	10%	㉓ Measure and reserve individually.
Grey mullet bottarga	10 g	5%	
Sea beans, blanched	10 g	5%	
Frying oil	as needed		
Lime juice	to taste		
Salt	to taste		

SHIGOKU OYSTER WITH FIZZY GRAPES, FRESH WASABI, AND MISO POWDER

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shiro miso	150 g	125%	① Dehydrate at 45 °C / 113 °F for 12 h.
			② Grind to fine powder, and reserve.
Shigoku oysters (or Kumamoto)	120 g (12 oysters)	100%	③ Shuck, reserving juice.
			④ Clean thoroughly.
			⑤ Refrigerate oysters.
			⑥ Strain juice, and measure 40 g.
Muscat grapes	120 g	100%	⑦ Blanch for 10 s.
			⑧ Shock in ice water.
			⑨ Peel, and halve through stem end.
Verjuice (store-bought)	50 g	42%	⑩ Combine.
Rice wine vinegar	5 g	4%	⑪ Pour over peeled grapes.
Salt	1 g	0.8%	⑫ Place grapes and juice into siphon.
			⑬ Charge with two cartridges of carbon dioxide at least 5 h before service, and refrigerate.
Wasabi (fresh)	8 g	6%	⑭ Grate finely, and reserve.
Oyster juice, from above	40 g	33%	⑮ Combine.
Verjuice	30 g	25%	⑯ Blend until smooth.
Sucrose esters (Sucro, Texturas brand)	0.7 g	0.58% (*1%*)*	⑰ Refrigerate.

(% of total weight of oyster juice and sour grape juice*)

It's hard not to poke fun at the geoduck, with its tiny clam shell, huge phallic neck, and ridiculous name—until you've tasted it. This is a delicacy in Japan that can command $30 a pound. Others have tried and failed to cultivate the largest burrowing clam in the world, which can live to be 150 years old. Here in its native Pacific Northwest, we are lucky that we can get them at Asian supermarkets. The name (pronounced "gooey duck") comes from the Nisqually Indian name *gwe-dek*, or "dig deep."

MARINATED GEODUCK, YOUNG GINGER, SHISO

Yields 255 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Live geoduck	400 g (one medium)	100%	① Blanch for 20 s in boiling water.
			② Shock in ice water.
			③ Peel off outer membrane, and clean stomach away from neck of clam.
			④ Slice siphon 2 mm / 1/16 in thick on diagonal to yield about 200 g.
			⑤ Refrigerate.
Japanese cucumber, thinly sliced	35 g	8.75%	⑥ Measure and reserve individually.
Scallions, white only, thinly sliced	10 g	2.5%	
Young ginger, julienne	4 g	1%	
Shiso leaves, chiffonade	4 g	1%	
Green chili, julienne	2 g	0.5%	
Lime juice	to taste		
Rice vinegar	to taste		
Smoked Japanese salt	to taste		
Usukuchi shoyu	to taste		

Geoduck should be peeled before use.

SPOT PRAWN AND LOTUS ROOT TEMPURA WITH SMOKED WHITE SOY SAUCE

Yields 600 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shrimp meat	150 g	75%	① Blend to fine paste.
Lard	15 g	7.5%	
Japanese potato starch	10 g	5%	
Egg yolk	8 g	4%	
Egg white	7 g	3.5%	
Sake	7 g	3.5%	
White soy sauce	7 g	3.5%	
Ginger, mashed to paste	2 g	1%	
Salt	2 g	1%	
Young lotus roots, peeled and sliced 1 cm / ⅜ in thick	90 g	45%	② Fill cavities of lotus root with shrimp paste. ③ Chill for 30 min until firm.
Live spot prawns	200 g (four prawns)	100%	④ Peel. ⑤ Refrigerate.
Sake	150 g	75%	⑥ Blend flour, rice flour, and baking powder; reserve.
Vodka	112 g	56%	⑦ Refrigerate sake, vodka, and malt syrup separately.
All-purpose flour	100 g	50%	
Rice flour	100 g	50%	
Malt syrup	12 g	6%	
Baking powder	3 g	1.5%	
Smoked white soy sauce see page 3·362	100 g	50%	⑧ Reserve.

The shrimp paste is delicious when used for making other fritters or as a filling for dumplings.

SEA URCHIN TOFU, TOKYO NEGI, SESAME, PONZU

Yields 400 g

INSPIRED BY YOSHIHIRO MURATA

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Hon dashi see page 2·306	200 g	100%	① Disperse gelatin and agar in cold dashi. ② Boil for 3 min to fully hydrate agar.
160 Bloom gelatin	3.6 g	1.8% *(0.9%)**	
Agar	0.4 g	0.2% *(0.1%)**	
Sea urchin tongues	200 g	100%	③ Blend into hot dashi. ④ Cast immediately into nonstick mold to create layer 3 cm / 1¼ in thick. ⑤ Refrigerate until gelatin is fully set, at least 5 h, before serving.
Tokyo negi, thinly sliced	40 g	13.3%	⑥ Measure and reserve individually.
Sous vide ponzu see page 2·313	80 g	26.6%	
Yuzu juice	8 g	2.6%	
Toasted-sesame oil	5 g	1.6%	

(% of total weight of dashi and sea urchin tongues)

PEN SHELL CLAM, PLUOT, MYOGA, SCALLOP MOCHI

Yields 650 g

The Pluot is a cross between a plum and an apricot. The first successful engineered cross, the plumcot, was created in the late 1800s and experimented with throughout the 1980s. But growers found it temperamental, and consumers were buying fewer plums. Enter the Pluot: a sweet, intensely flavorful new hybrid, mostly plum—but with an unblemished name.

For more on clarification and filtration methods, see page 2·352.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pluots (or red plums)	400 g	200%	① Juice. ② Clarify juice using preferred method. ③ Measure 200 g.
Malic acid	2 g	1%	④ Season juice.
White soy sauce	to taste		⑤ Refrigerate.
Pen shell clams, shucked	200 g	100%	⑥ Measure and refrigerate.
Scallop mochi see page 4·308	60 g (four pieces, 15 g each)		⑦ Measure and reserve individually.
Freeze-dried scallop powder, optional, see page 2·451	28 g	14%	
Frying oil	as needed		
Ginger oil see page 2·310	20 g	10%	⑧ Measure and reserve individually.
Dinosaur Pluot, thinly sliced (or red plum)	20 g	10%	
Myoga, fine julienne	12 g	6%	
Salt	to taste		⑨ Reserve.

BINCHO-TAN-GRILLED SEA CUCUMBER, MAITAKE MUSHROOM, SHISITO PEPPER

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Bincho-tan charcoal	as needed		① Reserve.
Live sea cucumber	160 g	100%	② Peel skin, and discard innards. Reserve only white meat from inner core.
			③ Refrigerate.
Matsutake mushrooms, peeled	120 g	75%	④ Measure and reserve individually.
Shisito peppers	80 g	50%	
Frying oil	as needed		
Large flaky salt (such as Maldon)	to taste		
Sansho pepper, finely ground	to taste		
Yuzu kosho (store-bought)	to taste		

ABALONE AND FOIE GRAS SHABU-SHABU WITH YUBA AND ENOKI

Yields 900 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Abalone	120 g	100%	① Steam at 100 °C / 212 °F for 12 h. Alternatively, vacuum seal, and cook sous vide in 90 °C / 194 °F bath for 16 h.
			② Reserve.
Raw foie gras	120 g	100%	③ Cut into slices 3 mm / ⅛ in thick.
			④ Refrigerate.
Soy yuba see page 4·115	120 g	100%	⑤ Measure and reserve.
Enoki mushroom	60 g	50%	⑥ Cut from stem into individual mushrooms.
Pea vines	80 g	66.6%	⑦ Select tender leaves and tips, and refrigerate.
Sweet onions, thinly sliced	300 g	250%	⑧ Sweat onions until very tender, about 30 min.
Rendered foie gras fat	70 g	58%	
Hon dashi see page 2·306	350 g	292%	⑨ Deglaze onions, and simmer for 30 min to make shabu-shabu broth.
			⑩ Strain.
			⑪ Centrifuge at 27,500*g* for 1 h.
			⑫ Cool and refrigerate.
Soy sauce	120 g	100%	⑬ Combine to make tosazu (dipping sauce).
Mirin	50 g	41.7%	⑭ Refrigerate.
Agave syrup	24 g	20%	
Rice vinegar	20 g	17%	
Foie gras fat or unsalted butter	80 g	66.7%	⑮ Measure and refrigerate.

Of the world's nearly 100 species of abalone, green and white are the most prized for their tenderness and flavor. White abalone is on the verge of extinction, however. It was the first marine invertebrate placed on the U.S. endangered-species list.

Americans don't give them much thought, but in Japan sea cucumbers have inspired thousands of haiku. They're thick and knobby, yes, but they're not vegetables. Rather, these firm gelatinous creatures bump brainlessly along the seafloor. When sliced, they have a slippery texture and are thought to possess a variety of health benefits, which scientists are now beginning to study.

OYSTER STEW

Milk skin, salsify, grilled avocado, lemon balm

Almost anywhere in the world oysters are shucked and slurped, you will find a stew or soup based on them. Living as we do in the Pacific Northwest, bounded by water, we would be remiss not to add one more.

This deconstructed version of oyster stew showcases oysters *escabeche* marinated in vinegar. The oysters are served in a bowl with translucent tapioca, a nod to French Laundry chef Thomas Keller's signature dish "oyster and pearls." Briny oyster consommé is poured over the mix. Savory skins of milk float like a veil on top. A fondant of salsify—a wildflower with a long, oyster-flavored root—deepens the flavor and delivers a creamy texture of melting sauce. Dots of avocado puree, flamed like crème brûlée, finish the dish.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, blowtorch*
OPTIONAL EQUIPMENT: *vacuum filtration equipment*
TIME REQUIRED: *3 h overall, including 35 min preparation and 45 min to finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
White Vegetable Stock see page 2·296	10 min	*45 min**		425 g
Clam Juice optional, see page 2·344		4 min		150 g
Oyster Escabeche	5 min	*10 min**	45 min	12 oysters
Oyster Consommé	10 min	30 min and *2 h**		300 g
Milk Skin (or Soy Yuba) see page 4·114 or page 4·115		30 min		60 g
Salsify Fondant	5 min	*1 h**		100 g
Pickled Tapioca Pearl		20 min		100 g
Avocado Puree	5 min		1 min	150 g
GARNISH				
Lemon balm leaves				12

**(unattended times)*

ASSEMBLY:

Marinate oysters in reserved escabeche mixture for 45 min, refrigerated.

While oysters finish marinating:

Pipe dots of avocado puree onto each plate. Char lightly with blowtorch.

Arrange cold salsify fondant, oysters, and milk skin or yuba on each plate.

Garnish with lemon balm leaves.

Pour cold oyster consommé at table.

OYSTER ESCABECHE

Yields 12 pieces

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Virginica oysters, or similar	12 oysters		① Shuck, reserve 50 g of juices for consommé and 40 g for the pickled tapioca pearls. Clean them well. ② Vacuum seal oysters, then poach sous vide in 45 °C / 113 °F bath for 10 min. ③ Cool in ice-water bath, and refrigerate.
Extra-virgin olive oil	45 g	100%	④ Combine.
Lime juice	24 g	53%	⑤ Refrigerate.
Sweet onions, finely minced	12 g	27%	
White wine vinegar	6 g	13%	
Bird's eye chili, thinly sliced	0.8 g	1.8%	
Bay leaf, julienne	0.2 g	0.4%	
Salt	to taste		

OYSTER CONSOMMÉ

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Clarified unsalted butter	95 g	95%	① Sauté prepared vegetables together until fragrant and scallions are translucent, about 7 min.
Scallions, thinly sliced	20 g	20%	
Ginger, peeled and thinly sliced	11 g	11%	
Galangal, peeled and thinly sliced	9 g	9%	
White vegetable stock see page 2·296	425 g	425%	② Add to scallion mixture, and mix. ③ Reduce to 300 g, about 15 min. ④ Strain. ⑤ Cool.
Roasted coconut juice (store-bought)	100 g	100%	
Clam juice see page 2·344	150 g	150%	
Sake (dry)	110 g	110%	
Lemongrass, thinly sliced	20 g	20%	
Cilantro leaves and stems	5 g	5%	⑥ Add to strained liquid.
Makrud (kaffir) lime leaf	2 g	2%	⑦ Steep in refrigerator for 2 h.
Oyster juice, from above	50 g	50%	⑧ Strain infused liquid, and season.
Lime juice	to taste		⑨ Clarify with vacuum filter.
Salt	to taste		⑩ Refrigerate.

For other suitable clarification techniques, see page 2·352. For more on clarifying butter, see page 4·213.

SALSIFY FONDANT

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Salsify, peeled and cut into 5 cm / 2 in lengths	100 g	100%	① Vacuum seal together.
			② Cook sous vide in 95 °C / 203 °F bath for 1 h.
Extra-virgin olive oil	20 g	20%	③ Cool and refrigerate.
Water	15 g	15%	
Lime juice	1.5 g	1.5%	
Salt	1 g	1%	

PICKLED TAPIOCA PEARL

Yields 200 g

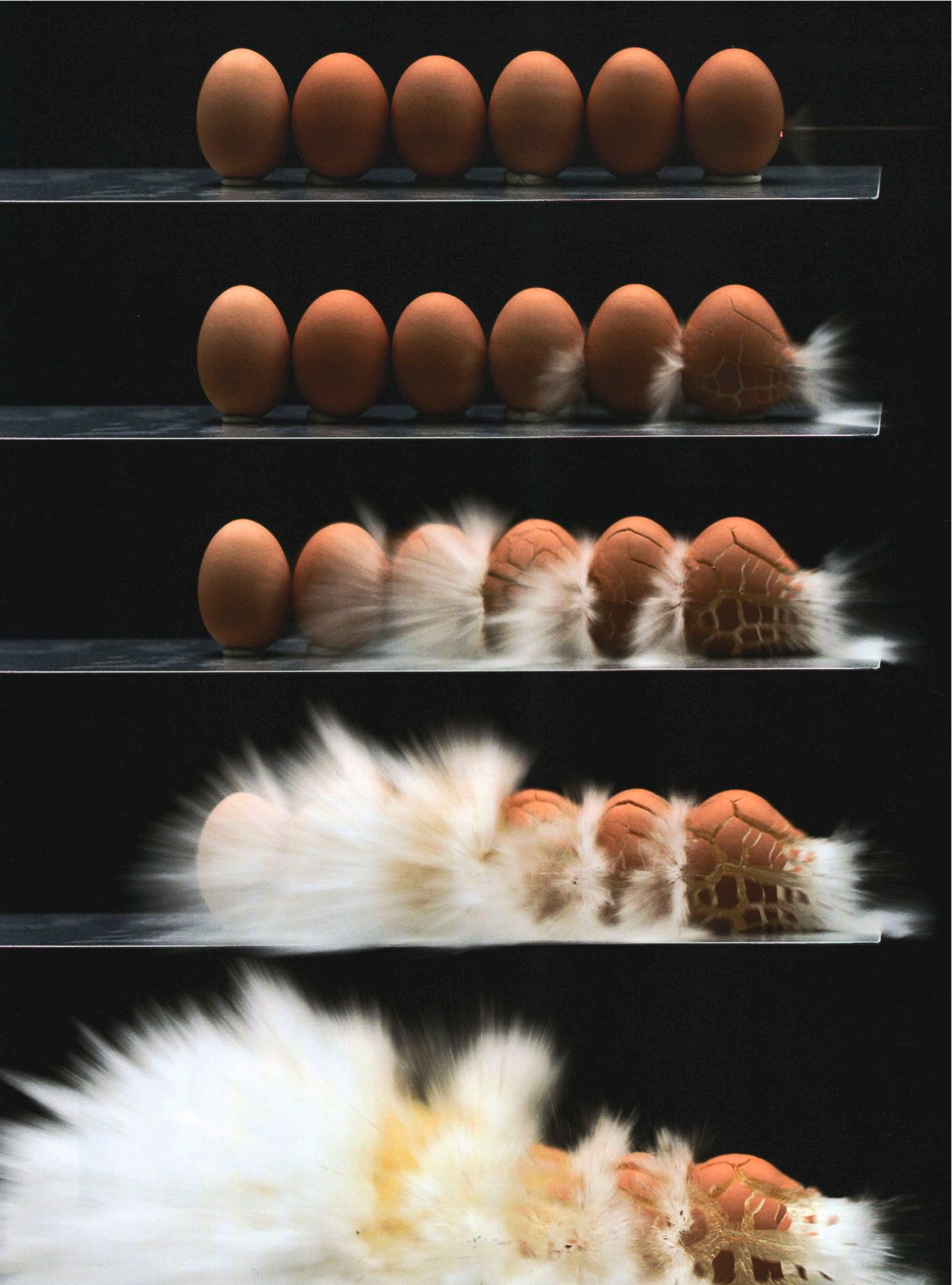
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tapioca pearls	100 g	100%	① Combine.
Water	200 g	200%	② Simmer until pearls are tender and translucent, about 20 min.
			③ Drain.
Rice wine vinegar	110 g	110%	④ Combine to make brine.
Oyster juice, from above	40 g	40%	⑤ Mix together brine and cooked tapioca pearls.
Sugar	15 g	15%	⑥ Vacuum seal, and refrigerate.
Lime juice	10 g	10%	
Salt	3 g	3%	

AVOCADO PUREE

Yields 150 g

ADAPTED FROM WYLIE DUFRESNE

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Hass avocado	140 g	100%	① Puree until smooth.
Ultra-Sperse 5 (National Starch brand)	5 g	3.6%	② Transfer to squeeze bottle, and refrigerate.
Ascorbic acid	1.4 g	1%	
Lime juice	1.4 g	1%	
Salt	to taste		



EGGS

An ultrahigh-speed camera shows what a glorious mess you can make with a gun, a bullet, and some eggs.

THE BREAKFAST EGG

Fried egg foam, sweet spices, coffee butter

Chef Alain Passard is one of the masters of contemporary French cuisine and a high-profile proponent of the farm-to-table movement. He is famous for many of his dishes, but perhaps his most famous creation isn't a dish at all—it's an amuse-bouche.

For years, every meal at his restaurant in Paris has begun the same way: with the L'Arpège egg. Chefs are forever trying to outdo each other's amuse-bouche, but this egg has earned a permanent place on Passard's menu.

To create the L'Arpège egg, Passard cuts off the top of an eggshell and drains the white. Then he floats the egg in a warm-water bath until the yolk has the consistency of custard; sprinkles on chives, clove, nutmeg, white pepper, and ginger; and tops it off with savory whipped cream, sherry vinegar, *fleur de sel*, and maple syrup. Let your spoon sink to the bottom of the egg, and pull in all the flavors at once: tart, sweet, sharp, deep. You could eat this egg every day and never tire of it.

Inspired by Passard's egg, we present a version that tips toward the classic American breakfast of fried eggs and bacon. Instead of crème fraîche, we blend cream and fried egg white to a fine puree, then whip it into a foam. Smoked syrup hints at the woodsy flavor of bacon. And, because not everyone has Passard's sense for when a warm water bath is heated just right, we've provided the temperature that yields a perfect pudding texture every time.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, whipping siphon*
OPTIONAL EQUIPMENT:	*handheld rotary grinder (Dremel)*
TIME REQUIRED:	*4 h 20 min overall, including 35 min preparation and 20 min to assemble*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Coffee Butter	2 min	*4 h**	3 min	40 g
Fried Egg Foam	15 min	3 min	15 min	200 g
Sweet Spice Blend	10 min			6 g
Compressed Green Apple	5 min			8 g
Egg Yolk Confit	5 min	45 min	15 min	80 g
GARNISH				
Smoked maple syrup (store-bought)				20 g
Flaky sea salt				to taste
Brioche, cut into soldiers 1 cm by 1 cm by 7 cm / ⅜ in by ⅜ in by 2¾ in	3 min		2 min	80 g (eight soldiers)

*(*unattended times*)

ASSEMBLY:

Charge egg-cream-filled siphon with two nitrous oxide cartridges.
Warm siphon and bag of egg yolk confit in **62** °C / **144** °F bath, about 15 min.

While eggs are reheating:
Remove green apple planks from bag and dice finely.
Heat eggshells in **100** °C / **210** °F oven for 5 min, using egg crate to hold them upright.
Warm coffee butter, and strain to remove beans.
Panfry brioche soldiers in coffee butter until golden brown on both sides, about 2 min total.

Once eggs are warmed:
Pipe 20 g of egg yolk confit into bottom of each eggshell.
Season with sweet spice blend, and top with small spoon of compressed apple.
Shake siphon thoroughly, and dispense fried egg foam up to edge of each eggshell.
Finish with smoked maple syrup and salt, and serve with brioche soldiers on side.

For more on extracting flavors using butter and other fats, see page 2·328.

Removing the shell from around the assembled egg reveals its distinct layers.

For more on vacuum-compressing fruits and vegetables, see page 3·391.

COFFEE BUTTER

Yields 125 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Roasted coffee beans, whole	175 g	100%	① Seal together in Mason jar, and steam for 4 h. Alternatively, vacuum seal, and cook sous vide in 90 °C / 195 °F bath for 4 h.
Unsalted butter	125 g	71%	② Refrigerate.

FRIED EGG FOAM

Yields 220 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Egg whites	60 g	100%	① Fry egg whites until golden brown.
Grapeseed oil	30 g	50%	② Drain oil, pat dry, and reserve.
160 Bloom gelatin	2.4 g	4%	③ Disperse gelatin in cold cream.
Heavy cream	130 g	217%	④ Bring to a simmer to dissolve gelatin fully.
			⑤ Blend in fried egg whites.
Salt	to taste		⑥ Season egg-cream mixture.
Black pepper, ground to fine powder	to taste		⑦ Press through fine sieve, and transfer to 1 l siphon.
			⑧ Refrigerate.

COMPRESSED GREEN APPLE

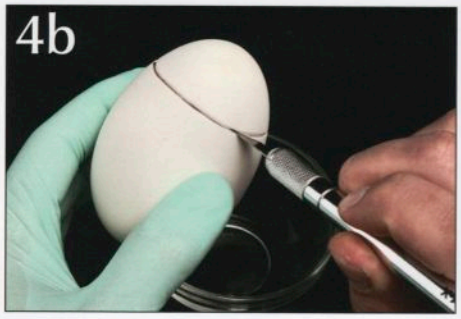
Yields 50 g

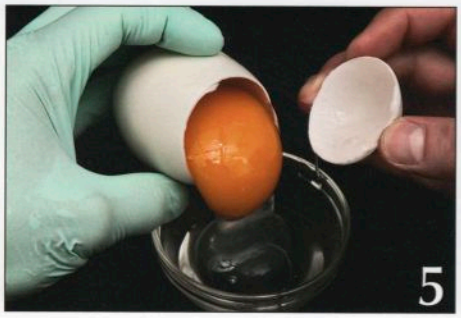
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Green apple	50 g	100%	① Cut into planks 3 mm / ⅛ in thick.
Green apple vinegar (or other sweet white vinegar)	1.5 g	3%	② Vacuum seal planks and vinegar to compress.
			③ Refrigerate.

SWEET SPICE BLEND

Yields 25 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Star anise, toasted and ground	10 g	100%	① Mix together.
			② Vacuum seal, and reserve.
Dried ginger, ground	4 g	40%	
Vanilla bean seeds and pulp	4 g	40%	
Black pepper, ground	3 g	30%	
Cinnamon, toasted and ground	3 g	30%	
Nutmeg, ground	1.5 g	15%	





Although an egg topper can remove the top of the shell, a Dremel tool and razor blade yield a more precise cut.

EGG YOLK CONFIT

Yields 80 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Egg yolks, blended	80 g	100%	① Vacuum seal. ② Cook sous vide in 67 °C / 153 °F bath for 45 min. ③ Cool and refrigerate.
Eggshells	four shells	100%	④ Remove top fifth of each shell with handheld rotary grinder (Dremel), egg topper, or razor-sharp knife. ⑤ Empty eggs, and clean shell interiors. ⑥ Straighten and smooth edges using grinder, and wash residual powder from shells. ⑦ Dry shells in 100 °C / 210 °F oven for 10 min. ⑧ Reserve.

If prepared as directed here, the egg yolks are fully pasteurized. See page 1·184 for more information on food safety considerations.

MUSHROOM OMELET

Mushroom marmalade, scrambled egg foam, fine herbs

The secret to perfectly cooked eggs has always been temperature control. That ultimate test of skill and dexterity for a classically trained chef—mastering eggs—is made easier with modern technology. Some of the world's best restaurants now have an amazing sous vide poached egg on the menu. The egg white is soft, the yolk is like custard; it is a texture previously unachievable in cooked eggs.

Accurate temperature control, a hallmark of Modernist cooking, transforms the omelet. This omelet is wafer-thin. The inside is filled with a smooth and lightened version of French-style scrambled eggs. We add a mushroom marmalade, flavored with fine herbs (chives, tarragon, parsley, and chervil), roll it up, and glaze it with clarified butter. Adding stripes of mushroom or truffle puree makes this omelet as stunning in appearance as flavor. But this recipe does not have to be fancy or fussy; leave out the stripes, and it is still unbelievably delicious. As simple as it seems, this may be our favorite recipe in the book.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, combi oven or water-vapor oven, whipping siphon*
OPTIONAL EQUIPMENT: *pastry comb*
TIME REQUIRED: *2 h overall, including 1½ h of preparation, and 15 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Mushroom Stock, optional **see page 129**	5 min	*1½ h**		330 g
Brown Chicken Jus **see page 2·344**	20 min	*1 h**		20 g
Scrambled Egg Foam	5 min	50 min	15 min	200 g
Mushroom Puree	5 min	30 min		330 g
Omelet Base	5 min	3 min	3 min	170 g
Mushroom Marmalade	30 min	25 min	5 min	35 g
GARNISH				
Clarified brown butter **see page 4·213**				20 g
Chive blossoms **optional**				40

*(*unattended times*)

ASSEMBLY:

Reheat egg-filled siphon in **70** °C / **158** °F water bath for 15 min if necessary.

Charge warmed siphon with one nitrous oxide cartridge, and shake vigorously to disperse gas.

While siphon is heating:

Warm mushroom marmalade, about 5 min, and add herbs just before plating.

Heat clarified brown butter to **90** °C / **195** °F.

Reheat omelet base squares in **82** °C / **180** °F combi oven with 100% humidity for 3 min, or reheat in CVap at same temperature with Browning set to 0. While omelets are still on baking sheet, dispense line of scrambled egg foam down centers.

Spoon marmalade in line next to scrambled egg foam.

Fold over omelet gently. Brush with hot brown butter.

Place on plates, and garnish with chive blossoms.

SCRAMBLED EGG FOAM

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Eggs, blended	100 g	100%	① Blend together.
Egg yolks	40 g	40%	② Vacuum seal.
Unsalted butter, melted	30 g	30%	③ Cook sous vide in 72 °C / 162 °F bath until texture is consistency of light pastry cream, about 25 min.
Whole milk	30 g	30%	
Salt	2 g	2%	④ Cool, then refrigerate if using later. If using immediately, pour into 1 l whipping siphon, charge with one cartridge of nitrous oxide, and keep warm.

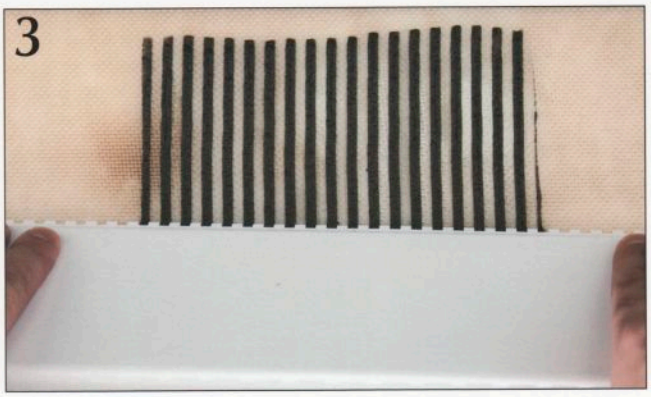
MUSHROOM PUREE OPTIONAL

Yields 330 g

Stripes of mushroom puree make for a visually stunning omelet, but skipping this step greatly simplifies the recipe and saves nearly an hour of effort. Also, omitting the stripes does not take away from what makes this omelet special: the remarkable texture. Truffle concentrate (see page 2·427) is a decadent substitute for the mushroom puree.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Mushrooms, thinly sliced (morel, porcini, shiitake, or chanterelle)	500 g	100%	① Sauté mushrooms until golden, about 10 min.
Clarified unsalted butter	60 g	12%	
Shallots, minced	100 g	20%	② Add to sautéed mushrooms, and cook over low heat until very tender, about 20 min. Portobello gills will darken mixture.
Portobello mushroom gills, spooned out	40 g	8%	
Water	330 g	66%	③ Deglaze pan of mushrooms.
			④ Simmer for 1 min.
Salt	7 g	1.4%	⑤ Blend mushroom mixture to fine puree.
			⑥ Pass through fine sieve.
			⑦ Season with salt, and reserve.

These photos illustrate the Omelet Base procedure on the next page.



OMELET BASE

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Eggs	145 g	100%	① Blend thoroughly to create egg base, and reserve.
Heavy cream	15 g	10.3%	
Egg yolks	12 g	8.3%	
Salt	2.5 g	1.7%	
Mushroom puree, from above	100 g	69%	② Combine, and spread onto silicone mat in layer 20 cm / 8 in square and 2 mm / 1/16 in thick.
Egg yolk powder	15.5 g	10.7%	③ Pull pastry comb with 3 mm / 1/8 in teeth through mushroom puree mixture to create even lines. If pastry comb is unavailable, proceed to step 4.
Heavy cream	10.3 g	7.1%	
Albumin powder, store-bought	8.8 g	6%	④ Pour egg base evenly over lines, 2 mm / 1/16 in thick.
Salt	1.7 g	1.1%	⑤ Steam in 82 °C / 180 °F combi oven with 100% humidity (or in a CVap set similarly), until set, about 3 min.
			⑥ Cut into four 5 cm / 2 in squares.
			⑦ Cool and refrigerate.

Pastry combs are usually used to decorate biscuit joconde and other sponge cakes. Here we use it to make an omelet with stripes that penetrate all the way from front to back.

MUSHROOM MARMALADE

Yields 35 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Mushrooms, thinly sliced and diced	80 g	100%	① Cook over very low heat until tender and liquid has evaporated, about 25 min.
Shallots, finely minced	60 g	75%	
Clarified unsalted butter	30 g	37.5%	
Brown chicken jus see page 2·344	20 g	25%	② Season mixture.
Black pepper, ground	to taste		③ Refrigerate.
Salt	to taste		
Chervil, finely minced	2 g	2.5%	④ Prepare herbs as noted.
Chives, finely minced	2 g	2.5%	⑤ Combine and refrigerate.
Parsley, finely minced	2 g	2.5%	
Tarragon, finely minced	1 g	1.25%	

Use morel, porcini, shiitake, or chanterelle mushrooms.

This marmalade will keep for several weeks refrigerated. It is worth scaling up the recipe to make a larger quantity, as the marmalade is a versatile condiment to have on hand.

OEUFS EN MEURETTE

Constructed pinot noir, crispy eggshell, traditional accompaniments

Eggs are one of the best dishes to illustrate sous vide and other low-temperature cooking techniques. Proper control of temperature is essential to cooking eggs because the proteins in the yolk and white have very specific responses to heat, as discussed on page 4·74. To showcase how these techniques provide that control, we developed several egg dishes for the book, including this updated approach to the Burgundian country classic *oeufs en meurette*.

Typically, the eggs are poached in a red wine sauce seasoned with shallots and aged wine vinegar. Served with bacon lardons, pearl onions, button mushrooms, and cubes of bread fried in butter, they are a vigneron's delight after a long day of harvest.

Our rendition of the dish takes advantage of some great insights from the Modernist pantry. We construct our red wine sauce from a puree of blackberries and blueberries cooked sous vide, and we tailor the nuances of the "wine" to suit our dish. Malic and tartaric acid provide sharpness, olive brine and shaved oak chips add depth, and tannin powder supplies balance. A mixture of red port and beet juice stain the poached egg to create a dramatic mottled purple pattern, akin to Chinese tea eggs. We hope you find the dish beautiful and inspiring.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment*
TIME REQUIRED: *14 h overall, including 2 h preparation and 20 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Cured Bacon **optional, see page 3·182**				250 g
Bacon Chips	10 min	*2 h** and *14 h**		100 g
Liquid Center Duck Egg	10 min	*1 h** and *12 h**	15 min	four eggs
Preserved Cinnamon Cap Mushrooms	2 min	7 min		30 g
Sous Vide Glazed Pearl Onions	5 min	*2½ h**	6 min	50 g
Constructed Red Wine Glaze	15 min	*1 h**	2 min	65 g
Brioche Toast			2 min	four slices
GARNISH				
Chive sprigs				four
Chervil leaves				four

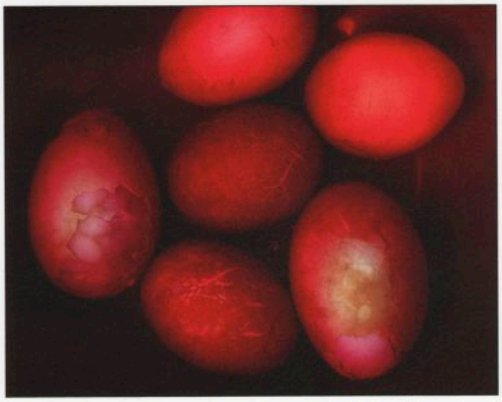
**(unattended times)*

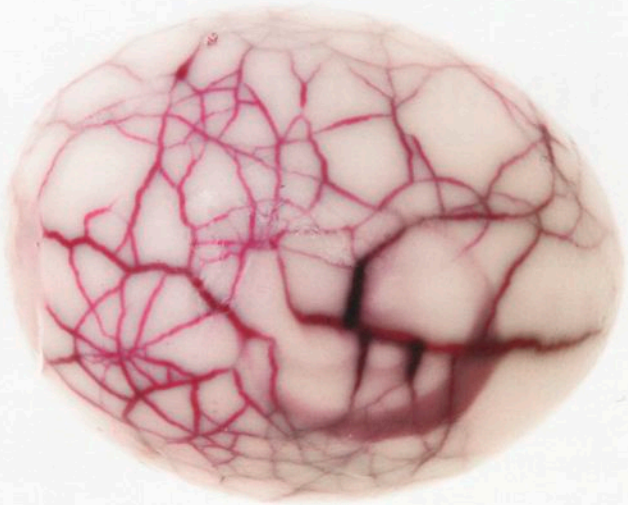
ASSEMBLY:

Reheat eggs in **62** °C / **143** °F bath for about 15 min.

While eggs are reheating:

Reheat pearl onions in **62** °C / **144** °F bath for 5 min.
Remove from bag, dry on paper towels, and cut in half lengthwise.
Sear in thin film of oil over high heat for 20 s.
Season with black pepper and salt.
Brush brioche slices with butter, and dust with albumin powder.
Fry until golden in nonstick pan, about 1 min on each side.
Season with salt.
Warm wine glaze, and whisk in cold butter. Taste for salt and acidity.
Arrange egg in center of each bowl, and season with flaky sea salt.
Garnish with mushrooms, bacon chips, and glazed onions.
Finish with herbs, and top eggs with brioche toasts.
Pour constructed wine glaze over eggs at table.





BACON CHIPS

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Maple syrup	50 g	20%	① Simmer together until dissolved.
Water	50 g	20%	② Cool syrup.
Glucose syrup DE40	45 g	18%	
Isomalt	25 g	10%	
Sorbitol	1 g	0.4%	
Cured bacon, sliced 1 mm / 1/16 in thick store-bought or see page 3-182	250 g	100%	③ Soak bacon slices in syrup in refrigerator for 2 h. ④ Dehydrate at 60 °C / 140 °F until crisp, 12–14 h. ⑤ Store chips in cool, dry place.

LIQUID CENTER DUCK EGG

Yields 340 g

The egg white needs more heat to coagulate than the yolk does, so first use boiling water to set the white firmly enough that it can be peeled later. Then use a low temperature water bath to cook the center. If substituting chicken eggs, which usually are smaller than duck eggs, you may need to reduce the initial boiling time to 3–3½ min.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Duck eggs	320 g (four eggs)	100%	① Immerse whole egg in boiling water for 4 min. ② Cool in ice-water bath for 20 min. ③ Cook in 62 °C / 143 °F bath for about 30 min. ④ Cool again in ice-water bath. ⑤ Crack eggshells gently all over with back of spoon, but do not remove shells. ⑥ Reserve.
Red beet juice	800 g	250%	⑦ Combine, reduce to 750 g, and cool.
Red port wine	350 g	109%	⑧ Immerse eggs in reduction, and soak in refrigerator for 12 h. ⑨ Drain, then gently peel off eggshells. ⑩ Refrigerate eggs.
Flaky sea salt	to taste		⑪ Reserve.

PRESERVED CINNAMON CAP MUSHROOMS

Yields 50 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cinnamon cap mushrooms	50 g	100%	① Cut into individual caps.
Frying oil	as needed		② Deep-fry mushroom caps in 175 °C / 350 °F oil until lightly golden, about 7 min. ③ Drain on paper towels. ④ Vacuum seal caps with 50 g of cooled oil.
Salt	to taste		⑤ Season and refrigerate.

SOUS VIDE GLAZED PEARL ONIONS

Yields 50 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pearl onions	50 g	100%	① Blanch for 1 min.
			② Shock in ice-water bath.
			③ Peel.
Water	20 g	40%	④ Combine.
Extra-virgin olive oil	5 g	10%	⑤ Vacuum seal with onions.
Black pepper	to taste		⑥ Cook sous vide in 90 °C / 194 °F bath for 2½ h.
Salt	to taste		⑦ Cool in ice-water bath.
			⑧ Refrigerate in sous vide bag.
Neutral oil	as needed		⑨ Reserve.
Black pepper	to taste		
Salt	to taste		

BRIOCHE TOAST

Yields 50 g

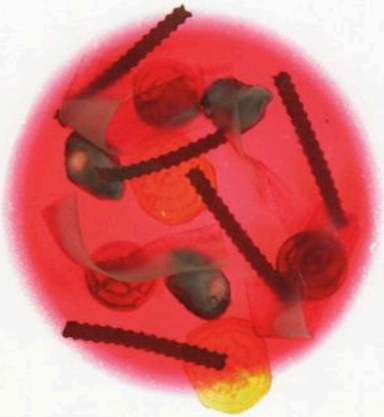
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Brioche, cut into four slices in desired shapes	50 g	100%	① Measure and reserve individually.
Clarified unsalted butter	20 g	40%	
Albumin powder	5 g	10%	
Salt	to taste		

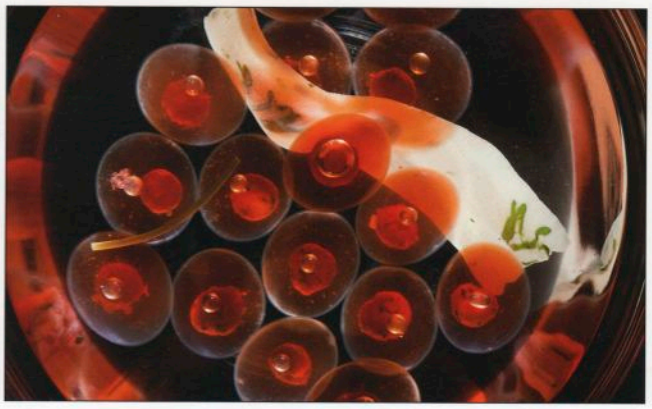
CONSTRUCTED RED WINE GLAZE

Yields 65 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Fresh blackberries	100 g	100%	① Vacuum seal.
Fresh blueberries	50 g	50%	② Cook sous vide in 65 °C / 149 °F bath for 1 h.
			③ Cool and puree.
			④ Pass through fine sieve.
Verjuice (store-bought)	50 g	50%	⑤ Blend well with 50 g of berry puree.
Kalamata olive brine (from store bought olives)	2 g	2.0%	⑥ Vacuum seal, and refrigerate.
Tannin powder (Obipektin brand Enocianin-A)	1.5 g	1.5%	
Tartaric acid	1 g	1.0%	
Fructose	0.5 g	0.5%	
Oak chips, grated	0.25 g	0.25%	
Malic acid	0.2 g	0.2%	
Salt	to taste		
Unsalted butter, cold	5 g	5%	⑦ Refrigerate.

STARCHES





COCOA TAJARIN

Bitter cocoa, Pacific sea urchin, pink grapefruit

In Italy, a pasta maker will tell you that spaghetti alla bolognese can't exist. Ask why, and he will point to a map: the ragù comes from Bologna in northern Italy; the spaghetti is from southern Italy—thus the two cannot be served together. No, ragù alla bolognese must be served with eggy tagliatelle noodles that are the specialty of the Emilia-Romagna region, where Bologna is located.

Each region covets its specialty. In the far northern Piedmont region, it's tajarin, known elsewhere in Italy as taglierini. True tajarin, however, has a higher egg yolk content than taglierini. The long, exquisitely thin noodle, made golden with egg yolk, is often served drenched in butter and wafted with white truffle shavings or sage. Pasta makers take pride in their ability to hand-cut tajarin (one Piedmont restaurant owner calls himself "the man with the golden arm"). The noodles taste silky and rich, thanks to the fat in the egg yolks. More than 25% of each yolk's weight is fat. This just so happens to be true of cocoa powder, too. Cocoa fat melts wonderfully, becoming a smooth, warm, and rich oil over a narrow temperature range right at body temperature. Replacing some of the flour in the noodles with cocoa powder gives them the richness of traditional tajarin, but with a particularly nice melt-in-your-mouth feel.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment*
TIME REQUIRED: *13 h overall, including 12 h to rest noodle dough. If making sea urchin bottarga, 90 d overall, including 1 h 5 min to prepare and 5 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Sea Urchin Bottarga **optional**	20 min	50 min and *90 d**		60 g
Pink Grapefruit Confit	30 min	*4 h**		60 g
Cocoa Tajarin	10 min and *12 h**		1 min	400 g
Sea Urchin Butter	5 min	10 min	3 min	150 g
GARNISH				
Grapefruit juice sacs **see page 2·462**				100 g
Black pepper, cracked				10 g
Tarragon leaves, cut into small squares				12
Sea urchin tongues				four

**(unattended times)*

ASSEMBLY:

Heat sea urchin butter reduction to a simmer, then blend in sea urchin tongues and butter until fully emulsified.
Season with pink grapefruit syrup, salt, and lime juice.
Melt cocoa butter.
Cook tajarin in boiling 3% salt water for 40 s.
Drain, and toss with warm cocoa butter.
Arrange tajarin on plates, and pour sea urchin butter over pasta.
Garnish with grapefruit droplets, grapefruit confit dice, and black pepper.
Finish with tarragon, sea urchin tongues, and grated sea urchin bottarga.
Pour sea urchin butter at the table.

SEA URCHIN BOTTARGA

Yields 150 g

Sea urchin "tongues" are called that because of their appearance. They are actually the gonads of the animal.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sea urchin tongues	200 g	100%	① Pass through fine sieve. ② Form sous vide bag into cone to mimic fish roe sacs. ③ Pipe into sous vide bag, and vacuum seal. ④ Cook sous vide in 64 °C / 150 °F bath for 50 min. ⑤ Refrigerate until fully hardened, about 20 min.
Salt	500 g	250%	⑥ Pack molded sea urchin pieces in salt. ⑦ Cure in refrigerator for 12 h. ⑧ Rinse, and pat dry. ⑨ Wrap tightly in cheesecloth, and hang in refrigerator to dry for 90 d.
Beeswax (food grade)	500 g	250%	⑩ Melt beeswax at 80 °C / 176 °F to ensure proper coating, and keep wax at same temperature. ⑪ Insert metal hook through narrow tip of bottarga, and dip three times in warm beeswax to form uniform coating. ⑫ Cool until hardened, about 10 min, and refrigerate.

Sea urchin bottarga is an optional garnish for Cocoa Tajarin (see page 3-186 for details). It's not difficult to make, but the air-drying step takes three months to complete. Grey mullet or tuna bottarga makes a decidedly different—but excellent—substitute. For a step-by-step procedure, see page 3-186.

PINK GRAPEFRUIT CONFIT

Yields 250 g

Most taste receptors in the mouth are geared toward detecting bitterness. That's because most poisonous foods have that quality, and we have evolved to detect things that might kill us. Bitter foods such as cocoa powder and grapefruit tend to be acquired tastes, and thus offer an interesting avenue for chefs to explore.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pink grapefruit peel with pith from one grapefruit, pulp reserved for garnish	200 g	100%	① Cut grapefruit peel into eight equal pieces. ② Blanch three times, starting from cold water each time.
Water	450 g	225%	③ Combine water and salt, and bring to a boil.
Salt	60 g	30%	④ Add peel, and simmer for 8 min. ⑤ Drain, rinse, and cool. ⑥ Reserve.
Fructose	210 g	105%	⑦ Stir together to make syrup.
Water	210 g	105%	⑧ Add blanched peel to syrup.
Isomalt	92 g	46%	⑨ Cook sous vide in 90 °C / 194 °F bath for 4 h.
Citric acid	4.5 g	2.25%	⑩ Cool in ice-water bath. ⑪ Reserve 30 g of syrup for sea urchin butter. ⑫ Dice chilled peel finely, and return to remaining syrup. ⑬ Vacuum seal, and refrigerate.

COCOA TAJARIN

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
00 wheat flour	127 g	100%	① Dry blend together.
Semolina flour	85 g	67%	
Dutch processed cocoa powder	57 g	45%	
Vital wheat gluten	5 g	4%	
Salt	2 g	1.5%	
Egg yolks	153 g	120%	② Add to flour mixture, and knead for 10 min to make dough.
Water	35 g	28%	
Extra-virgin olive oil	29 g	23%	③ Vacuum seal. Refrigerate for 12 h.
			④ Roll into sheets 1 mm / 1/32 in thick.
			⑤ Cut into noodles 2 mm / 1/16 in wide.
			⑥ Place on parchment paper, cover with damp towel, and refrigerate.
Deodorized cocoa butter (food-grade)	40 g	31.5%	⑦ Reserve.

SEA URCHIN BUTTER

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sake (dry)	200 g	100%	① Combine in pot, and reduce to 150 g, about 10 min.
Vermouth (dry)	150 g	75%	② Strain and refrigerate.
Shallots, finely minced	50 g	25%	
Champagne vinegar	25 g	12.5%	
Tarragon leaves, minced	1 g	0.5%	
Black peppercorns, coarsely ground	0.25 g	0.13%	
Sea urchin tongues	40 g	20%	③ Measure and refrigerate individually.
Pink grapefruit confit syrup, from above	30 g	15%	
Unsalted butter, cubed	30 g	15%	
Lime juice	to taste		
Salt	to taste		

The creaminess and iodine flavor of the sea urchin tongues enrich this sauce, but it is the salt that moderates the bitterness of the cocoa powder and grapefruit in the dish. Salt, not sugar, masks bitter tastes, for reasons that neuroscientists are still trying to understand.

Allowing the tajarin dough to rest overnight provides time for the gluten to relax, yielding a less-elastic dough that can be rolled thinner without shrinking or tearing.

SPAGHETTI ALLE VONGOLE

Bagna càuda, venus clam, young garlic

Two things matter when making spaghetti alle vongole: the quality of the noodle and the quality of the clams.

This dish is traditionally prepared with dry pasta. Although certain pastas, like ravioli, are best fresh, others such as spaghetti, must be al dente—slightly firm to the bite—when cooked. That texture is impossible to achieve with fresh pasta. After all, if the center of the noodle is wet and soft before it goes into the pot, it will not yield that toothsome snap that comes from a core still slightly firm after it comes out.

Store-bought dried pasta works in this dish, as does spaghetti made the traditional way and hung out to dry, as they do in the southern region of Italy that is home to this dish. Vacuum-drying the noodles (see page 3·384) is a speedier approach. As a third option, use our Ramen noodles (see page 250), whose high gluten content allows them to be al dente even when cooked fresh. If you use store-bought spaghetti, look for a rough texture on the noodles, evidence they were extruded through dies made of bronze, rather than steel or teflon. The rougher noodles gain a better grip on the *bagna càuda* consommé.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment*
OPTIONAL EQUIPMENT: *combi oven, centrifuge*
TIME REQUIRED: *4½ h overall, including 2 h preparation and 10 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Vacuum-Dried Semolina Spaghetti see page 3·384	10 min	*4 h**	7 min	150 g
Garlic Confit see page 3·354	5 min	2 h		31.5 g
Clam Juice	2 min	3 min		155 g
Bagna Càuda Consommé	10 min	20 min and *1 h**	2 min	100 g
Brown Butter–Poached Green Garlic	5 min	1 h	1 min	20 g
Walnut Clam Marmalade	10 min	15 min	2 min	10 g
Parsley Foam	15 min		2 min	20 g
Stuffed Clams	10 min	15 min	2 min	12

**(unattended times)*

ASSEMBLY:

Cook spaghetti in boiling 2% salt water until al dente, about 7 min.

While spaghetti is cooking:

Top stuffed clams with bread crumbs.
Broil until golden brown and warmed through, about 2 min.
Reheat walnut marmalade.
Fold in chives and parsley, and season with salt and lemon juice.
Warm butter-poached green garlic.
Reheat the bagna càuda consommé, and verify seasoning.
Arrange spaghetti in center of each bowl.
Top each bowl of spaghetti with three stuffed clams, four pieces of butter-poached garlic, and walnut marmalade.
Foam parsley juice with immersion blender or handheld wand mixer (see page 4·252 for step by step), and spoon around bowls.
Pour bagna càuda consommé at table.

CLAM JUICE

Yields 175 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Clams, rinsed and soaked to remove sand	475 g	100%	① Combine. ② Vacuum seal.
Shallots, minced	10 g	2%	③ Steam or boil for 3 min until clams have just released their juices.
Thyme	0.3 g	0.06%	④ Cool.
Bay leaf	0.1 g	0.02%	⑤ Strain juices; reserve solids for another use.
			⑥ Measure 160 g of clam juice, and refrigerate.

BAGNA CÀUDA CONSOMMÉ

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Garlic cloves, green removed and thinly sliced	80 g	52%	① Sauté garlic in oil until golden, and reserve.
Grapeseed oil	80 g	52%	
Sweet onions, sliced	75 g	48%	② Sauté onions in butter and oil until translucent.
Unsalted butter	50 g	32%	
Olive oil	25 g	16%	
Clam juice, from above	155 g	100%	③ Add reserved garlic and remaining ingredients to onions, and simmer for 20 min.
Water	155 g	100%	
White wine (dry)	50 g	32%	④ Cool.
Garlic confit see page 3-354	27 g	17.5%	⑤ Process in centrifuge at 27,500*g* for 1 h, or use alternative clarification method.
Anchovy, chopped	25 g	16%	⑥ Refrigerate.
Chives, minced	2 g	1.3%	
Thyme, minced	1 g	0.6%	

For more on other clarification strategies, see page 2-352.

BROWN BUTTER–POACHED GREEN GARLIC

Yields 60 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Clarified brown butter	90 g	150%	① Cook over low heat for 1 h.
Green garlic cloves, peeled	60 g	100%	② Refrigerate.

For more on making brown butter, see page 4-213.

WALNUT CLAM MARMALADE

Yields 125 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Button mushrooms, brunoise	200 g	100%	① Sauté mushrooms until tender and all moisture has evaporated, about 15 min.
Unsalted butter	40 g	20%	② Measure 40 g.
Clam meat, from below, finely minced	25 g	12.5%	③ Fold into mushrooms. ④ Refrigerate.
Walnuts, finely crushed	7 g	3.5%	
Walnut oil	4.5 g	2.25%	
Clam juice, from above	5 g	2.5%	
Chives, finely minced	2 g	1%	⑤ Measure and reserve individually.
Parsley, finely minced	2 g	1%	
Lemon juice	to taste		
Salt	to taste		

PARSLEY FOAM

Yields 265 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Parsley juice	265 g (from about 500 g parsley)	100%	① Blend together until powder is thoroughly incorporated.
Deoiled soy lecithin powder	4 g	1.5%	
Salt	1 g	0.4%	② Season parsley juice mixture, and refrigerate.

For more on juicing strategies, see page 2·338.
Foaming methods are discussed on page 4·252.

STUFFED CLAMS

Yields 12 pieces

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Littleneck or Manila clams, cleaned and washed	885 g	100%	① Vacuum seal together. ② Cook sous vide in 70 °C / 158 °F bath for 15 min.
Shallots, thinly sliced	13.5 g	1.5%	③ Shuck clams, reserving clams, juice, and shells separately.
Garlic, thinly sliced	0.9 g	0.1%	
Thyme	0.8 g	0.1%	④ Strain clam juice through fine sieve.
Bay leaf	0.2 g	0.02%	⑤ Measure 25 g of clams and 4 g of clam juice for making walnut marmalade, and reserve. ⑥ Vacuum seal clams and juice individually, and refrigerate. ⑦ Reserve 12 whole shells.
Button mushrooms, finely minced	50 g	5.6%	⑧ Sauté until lightly golden and tender, about 4 min.
Unsalted butter	10 g	1%	
White wine	5 g	0.5%	⑨ Add to pan of mushrooms. ⑩ Cook until liquid is evaporated, and cool.
Parsley, finely minced	15 g	1.7%	⑪ Fold parsley and garlic confit into mushrooms.
Garlic confit, finely minced see page 3·354	4.5 g	0.5%	⑫ Season with salt.
Salt	as needed		
Sous vide cooked clams, from above	100 g	11%	⑬ Put one clam in each reserved shell. ⑭ Top each clam with about 5 g of mushroom mixture. ⑮ Refrigerate.
Bread crumbs, finely powdered	as needed		⑯ Reserve.

Add a few hot chili slices to your soaking water when purging clams or other bivalves of sand and impurities. The capsaicin in the chili will irritate the shellfish and cause them to release sand and other impurities.

RUSSIAN PELMENI

Heather-smoked sturgeon, Kusshi oysters, golden beets, poppy seeds

The provenance of these savory little dumplings reads like a Russian folktale. They probably originated in China—which would explain their similarity to pot stickers—and were then carried by Mongols to Tatarstan and Siberia, where the indigenous people called them *pel'nyan'*, or "ear bread." Eventually, the dumplings spread to the rest of Russia, where they are known today as pelmeni or Siberian dumplings. Our pelmeni are a type of ravioli, wrapped in squares of buckwheat flour, to which we add all-purpose flour as well as Activa, whose protein-binding enzymes firm the dough. The rillettes filling is made from wild sturgeon, which is smoked in heather blossoms for a wonderful, ethereal flavor, then shredded. The dough is rolled thin, cut, filled, pinched, twirled around a finger, and boiled. As an alternative, the buckwheat dough can be rolled and cut into noodles, then served with a borscht-inspired broth with oysters and beets.

YIELD: *four portions*
SPECIAL EQUIPMENT: *smoker, sous vide equipment*
TIME REQUIRED: *13 h overall, including 2 h preparation and 15 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Buckwheat Dough	20 min	*12 h**		525 g
Beet Juice-Fed Oysters optional, see page 3·206	10 min	*12 h**		12 oysters
Heather-Smoked Sturgeon	5 min	*8 h** and *4 h**		100 g
White Fish Stock see page 2·303	10 min	*1½ h**		240 g
Sous Vide Baby Golden Beets	10 min	*1 h**	8 min	80 g
Borscht Broth optional	10 min	*30 min**	2 min	200 g
Salted Cucumber	5 min	*1 h**		40 g
Heather-Smoked Sturgeon Rillettes	5 min	*30 min**		200 g
Oyster Butter Emulsion	5 min	25 min	5 min	100 g
Buckwheat Pelmeni	25 min		1½ min	four dumplings, 55 g each
Poached Oysters	20 min		10 min	12 oysters
Basic Mayonnaise see page 4·226	7 min			75 g
GARNISH				
Clarified brown butter see page 4·213				28 g
Black poppy seeds				10 g
Young beet greens				12 leaves

**(unattended times)*

ASSEMBLY:

Cook oysters sous vide in **45** °C / **113** °F bath for 10 min.

While oysters are cooking:

Warm oyster butter reduction. Blend in butter and crème fraîche to form emulsion. Season.

Warm poached beets at **88** °C / **190** °F for 15 min. Cut into thin slices.

While oyster butter is heating:

Cook pelmeni in 3% salt solution for 1½ min.

Warm borscht broth, and season with salt and caraway powder.

Warm brown butter in small pot, and place pelmeni in butter.

Toss in poppy seeds, and baste pelmeni with butter for 30 s.

Arrange pelmeni on each plate.

Finish with oyster bellies, sliced golden beets, and cucumber cubes.

Garnish with warm brown butter and beet leaves. Pour hot oyster butter and broth at table.

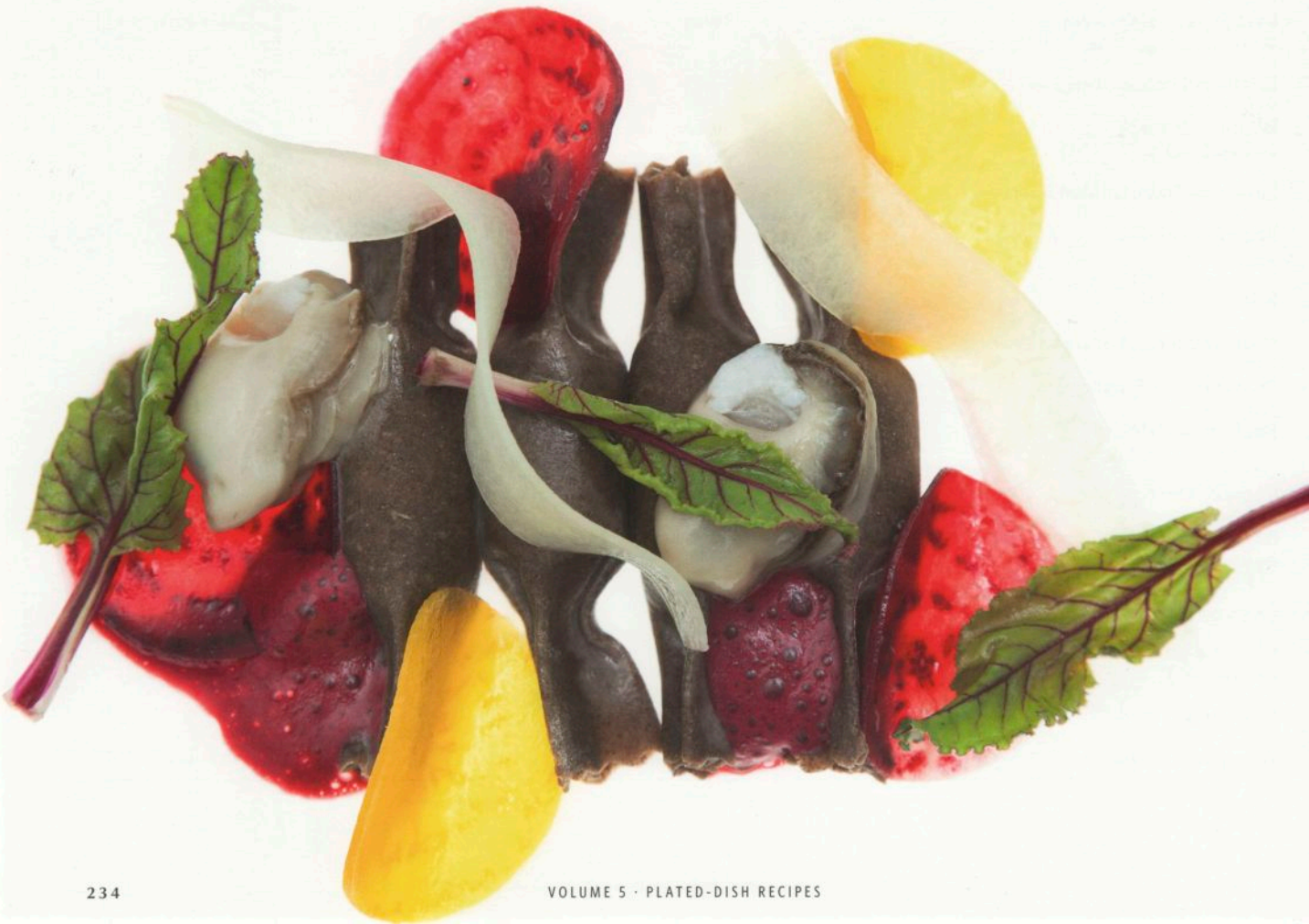
BUCKWHEAT DOUGH

Yields 525 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Buckwheat flour	200 g	100%	① Sift.
All-purpose flour	100 g	50%	② Combine with sifted buckwheat flour in food processor.
Activa TI or RM	12 g	6% (*4%*)*	③ Process to mix thoroughly.
Salt	3.5 g	1.75%	
Whole milk	150 g	75%	④ Blend thoroughly into flour mixture.
Egg yolks	75 g	37.5%	⑤ Transfer dough to floured surface, and knead for 10 min.
Grapeseed oil	40 g	20%	⑥ Vacuum seal.
			⑦ Refrigerate for 12 h to allow enzyme to bind proteins.

(% of total weight of both flours*)

Activa strengthens low-gluten noodles, but anyone with celiac disease should avoid eating noodles made with Activa in them.



HEATHER-SMOKED STURGEON

Yields 450 g

INGREDIENT	QUANTITY	SCALING
Wild sturgeon fillet	500 g	100%
Vodka	35 g	7%
Salt	20 g	4%
Sugar	7 g	1.4%
Lemon zest, finely grated	2 g	0.4%
Cherrywood chips	750 g	150%
Dried heather blossoms	100 g	20%

PROCEDURE

① Combine vodka, salt, sugar, and zest to make cure. Coat fillet evenly with cure.
② Vacuum seal.
③ Cure in refrigerator for 8 h.
④ Rinse, and pat dry with paper towels.
⑤ Smoke fillet with blossoms and chips at 52 °C / 125 °F and relative humidity of 50% for 4 h. Cool.

The temperature and humidity given here will produce a wet-bulb temperature of about 40 °C / 104 °F (see page 2-132).

HEATHER-SMOKED STURGEON RILLETTES

Yields 200 g

INGREDIENT	QUANTITY	SCALING
Shallots, finely minced	15 g	15%
White balsamic vinegar	13 g	13%
Heather-smoked sturgeon, from above	100 g	100%
Basic mayonnaise see page 4-226	75 g	75%
Celery, finely minced	9 g	9%
Chives, minced	5 g	5%
Celery leaf, minced	1.5 g	1.5%
Chervil, minced	1.5 g	1.5%
Tarragon, minced	1.5 g	1.5%
Smoked salt	1.2 g	1.2%
Ultra-Sperse 3 (National Starch brand)	1.2 g	1.2%
Lime zest, finely grated	1 g	1%
Lemon juice	0.7 g	0.7%

PROCEDURE

① Marinate shallots at room temperature for 30 min.
② Shred sturgeon.
③ Combine shallots, sturgeon, and remaining ingredients in stand mixer.
④ Whip on medium-high speed until fluffy and all ingredients are well incorporated.
⑤ Reserve for pelmeni filling.

Store-bought sturgeon can be substituted in this recipe.

SOUS VIDE GOLDEN BEETS

Yields 225 g

INGREDIENT	QUANTITY	SCALING
Golden beets	250 g	100%
Extra-virgin olive oil	75 g	30%
Water	50 g	20%
Salt	3.5 g	3.5%
Thyme	2 g	0.8%

PROCEDURE

① Vacuum seal together.
② Cook sous vide in 88 °C / 190 °F bath for 1 h.
③ Drain, reserving cooking juices.
④ Peel off skins with a dry paper towel.
⑤ Vacuum seal peeled beets and juices together.
⑥ Refrigerate.

Red beets also work well, and a mix of red and golden is quite attractive. But cook them separately to keep the colors pure.

BORSCHT BROTH OPTIONAL

Yields 400 g

INGREDIENT	QUANTITY	SCALING
Red beet juice	200 g	100%
Water	110 g	55%
White fish stock see page 2-303	90 g	45%
Rhubarb juice	16 g	8%
Red wine vinegar	8 g	4%
Caraway seeds, finely ground	to taste	
Salt	to taste	

PROCEDURE

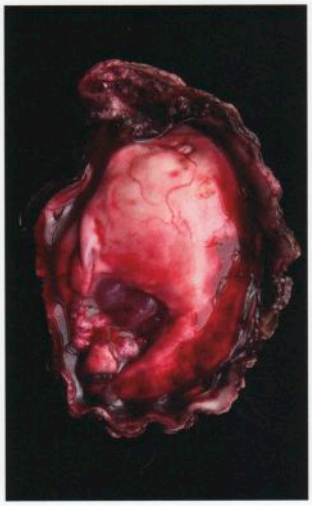
① Vacuum seal together.
② Cook sous vide in 85 °C / 185 °F bath for 30 min.
③ Pass through fine sieve, and cool.
④ Reserve.

Many Russians believe you can't eat borscht without sour cream, the classic accompaniment to this soup.

SALTED CUCUMBER

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
English cucumber, peeled, halved, and seeded	200 g	100%	① Cut into planks 3 mm by 5 cm / ⅛ in by 2 in.
Salt	4 g	2%	② Sprinkle evenly over planks, and cover. ③ Let water drain from cucumbers for 1 h. ④ Rinse, and pat dry. ⑤ Vacuum seal to compress. ⑥ Cut into cubes, and refrigerate.



Feeding beet juice to oysters gives the mollusks a stunning red color.

POACHED OYSTERS

Yields 12 oysters

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Fresh Kusshi oysters (or beet juice–fed Kusshi oysters) see page 3·206	12 oysters	100%	① Shuck. ② Strain and reserve juice, measuring 50 g for oyster butter emulsion and 25 g for poaching oysters. ③ Wash oysters in fresh cold water several times. ④ Pat dry with paper towels. ⑤ Trim off lips and hinges, leaving only plump bellies. ⑥ Reserve trimmings for oyster butter emulsion.
Oyster juice	25 g	25%	⑦ Vacuum seal oysters and juice together. ⑧ Refrigerate.

OYSTER BUTTER EMULSION

Yields 225 g

For more on making clarified butter, see page 4·213.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Shallots, finely minced	75 g	150%	① Sweat together until tender, about 10 min.
Clarified unsalted butter	50 g	100%	
Celery, peeled and finely minced	35 g	70%	
Oyster trimmings, from above	35 g	70%	② Add to shallot mixture. ③ Sweat for 2 min.
White vermouth	200 g	400%	④ Add to shallot mixture.
White fish stock see page 2·303	150 g	300%	⑤ Simmer until reduced to 150 g.
Oyster juice, from above, strained	50 g	100%	
Darjeeling tea leaves	7 g	14%	⑥ Steep in shallot reduction for 3 min. ⑦ Strain. ⑧ Cool. ⑨ Refrigerate.
Unsalted butter	50 g	100%	⑩ Measure and reserve individually.
Crème fraîche	25 g	50%	
White wine vinegar	5 g	10%	
Salt	to taste		

BUCKWHEAT PELMENI

Yields 565 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Egg, blended	50 g	20%	① Combine to make egg wash.
Water	15 g	6%	
Buckwheat dough, from above	250 g	100%	② Dust work surface with unbleached flour.
			③ Roll out dough 1.5 mm / 1/16 in thick.
Unbleached flour	as needed		④ Divide dough into two sheets, each measuring 12 cm by 60 cm / 4¾ in by 23½ in.
Heather-smoked sturgeon rillettes, from above	200 g	80%	⑤ Cut each dough sheet into six 7 cm / 2¾ in squares; makes 12 squares total.
			⑥ Spoon about 12 g rillettes onto each square.
			⑦ Brush edges of square with egg wash.
			⑧ Fold over one corner of square on diagonal to form triangular packet.
			⑨ Press packet edges together firmly to seal.
			⑩ Wrap triangle around finger, and pinch together moistened, pointed ends to seal.
			⑪ Repeat packet-making steps until all dough squares are used.
			⑫ Cover pelmeni with slightly damp towel, and refrigerate.

PAELLA VALENCIANA

Rabbit, langoustine, garden snail, horchata emulsion, soccarat tuile

There is nothing dainty about paella. It is a dish that used to feed legions of grape pickers toiling in hot fields during harvest time in Valencia. A huge pan (called a *paella* or *paellera*) would be set in the field to cook rice. Grapevine trimmings were burned for fuel.

Any number of things went into the pan: snails, which were freely available in the fields, tomatoes, onions, and—if you were better off—chicken, rabbit, or duck. Coastal regions substituted seafood for the meat, and cooks later mixed meat and seafood.

We don't make our paella in an open field, but we try to recapture some of those original elements. The snails are cooked sous vide until they are meltingly tender. The rice is smoked first to re-create the aroma of burning grapevines. Fields or no fields, paella is still a feast best enjoyed by a large group of friends.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment*
OPTIONAL EQUIPMENT: *freeze dryer*
TIME REQUIRED: *13 h overall (24 h if making Smoked Bomba Rice), including 2 h preparation and 30 min to reheat and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
White Chicken Stock see page 2·301	20 min	*1½ h**		550 g
Paella Stock	15 min	1½ h		200 g
Puffed Wild Rice see page 4·307		1 min		125 g
Smoked Bomba Rice optional, see page 3·362		*24 h**		125 g
Freeze-dried Piquillo Pepper optional, see page 3·372		*12 h**		11 g
Blood Sausage see page 3·238	20 min	*30 min**	*20 min**	600 g
Paella Rice	10 min	12 min	7 min	350 g
Sous Vide Rabbit Loin		*8 h** and *25 min**	*20 min**	320 g
Sous Vide Braised Snails	5 min	*5 h**	*20 min**	80 g
Sofrito	20 min	*1 h**	2 min	60 g
Sous Vide Artichoke	10 min	*45 min**	*20 min**	60 g
Horchata Foam	5 min	*12 h** and 10 min	2 min	40 g
Puffed Wild Rice see page 4·302		1½ min		50 g
Soccarat Tuile	5 min	*1 h**		four crisps
Seared Langoustine Tails			2 min	four

**(unattended times)*

ASSEMBLY:

Reheat rabbit loin, blood pudding, snails, and artichokes in **58** °C / **136** °F bath about 20 min.

Finish cooking smoked paella rice by adding stock to rice-onion mixture a little at a time until al dente, about 5 min. Remove from heat, and add saffron. Season with salt.

Reheat sofrito in sauté pan just until warmed through, about 2 min.

Sear langoustines in oil until golden and just cooked through, about 1 min on each side. Season with salt.

Foam horchata with handheld foaming wand or immersion blender until thick foam layer forms.

Dust rabbit loin with piquillo pepper powder, and then slice on a bias, 1 cm / ⅜ in thick.

Slice blood pudding 2 cm / ¾ in thick.

Spoon rice into each bowl.

Arrange slices of rabbit loin and blood pudding, braised snails, one artichoke, and one langoustine on top of each portion of rice.

Garnish with horchata foam and soccarat tuile.

PAELLA STOCK

Yields 750 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Rabbit trimmings	350 g	35%	① Brown in **190** °C / **375** °F oven until golden, about 25 min.
Rabbit carcass	335 g	34%	
Yellow onions, thinly sliced	125 g	12%	② Sweat until translucent, about 5 min.
Grapeseed oil	100 g	10%	
Tomatoes, peeled and seeded	100 g	10%	③ Add to onions, and sauté vegetable mixture until golden, about 7 min.
Carrots, thinly sliced	75 g	7.5%	
Leeks, thinly sliced	60 g	6%	
Fennel, thinly sliced	55 g	5.5%	
Piquillo peppers, thinly sliced	40 g	4%	
Pimentón de la Vera (sweet)	6 g	0.6%	
Thyme	2.25 g	0.2%	
Water	1 kg	100%	④ Combine with browned rabbit pieces and vegetable mixture.
White chicken stock see page 2-301	550 g	55%	⑤ Pressure-cook at a gauge pressure of 1 bar / 15 psi for 1 h.
			⑥ Cool.
			⑦ Strain through fine sieve.
			⑧ Refrigerate.

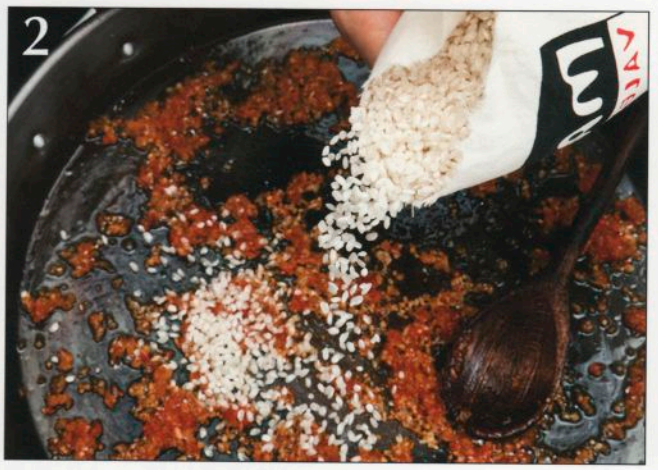
PAELLA RICE

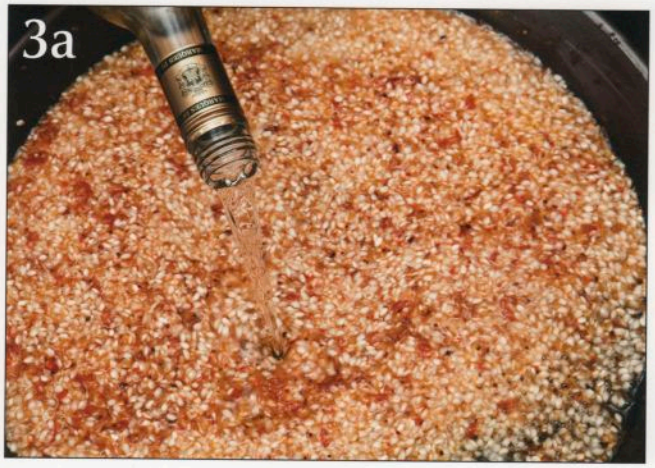
Yields 350 g

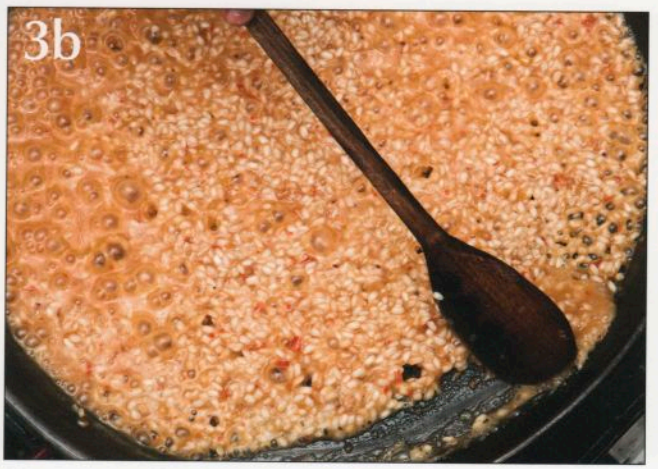
INGREDIENT	QUANTITY	SCALING	PROCEDURE
Spanish onions, finely minced	25 g	20%	① Sauté in the bottom of a pressure cooker until translucent and tender, about 7 min.
Olive oil	20 g	16%	
Piquillo pepper, finely minced	20 g	16%	
Sweet pimento pepper, finely minced	15 g	12%	
Smoked bomba rice (or regular bomba rice) see page 3·362	125 g	100%	② Add rice to onion mixture, and cook until translucent, about 2 min.
Spanish white wine (dry and fruity)	35 g	28%	③ Add wine and 150 g of stock to rice-onion mixture, and pressure-cook for 3 min at a gauge pressure of 1 bar / 15 psi.
Paella stock, from above	325 g	260%	④ Run cold water over pressure cooker. ⑤ Drain rice, discarding liquid. ⑥ Spread rice on chilled baking sheet to speed cooling. ⑦ Transfer to container, and refrigerate. ⑧ Refrigerate remaining 175 g stock.
Saffron threads	2 g	1.6%	⑨ Reserve individually.
Salt	to taste		

Paella traditionally uses bomba rice, which is indigenous to Spain. It soaks up enough stock to swell to three times its dry volume. It expands in width rather than length, remains firm after cooking, and does not become sticky.

For more on other ways to parcook rice, see page 3·304.







SOUS VIDE RABBIT LOIN

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Rabbit loins, trimmed and silver skin removed	450 g	100%	① Dust rabbit loins evenly with Activa.
Activa RM or GS	10 g	2.2%	② Position opposing loins, tapered sides together, to form even cylinders 3 cm / 1¼ in. in diameter.
			③ Wrap each pair of loins tightly in plastic wrap, and vacuum seal.
			④ Refrigerate for at least 6 h to allow enzyme to bind loins.
Extra-virgin olive oil	50 g	11%	⑤ Vacuum seal loins with oil.
			⑥ Cook sous vide in 57 °C / 135 °F bath to core temperature of 56 °C / 133 °F, about 25 min.
			⑦ Cool in ice-water bath. Refrigerate.
Freeze-dried piquillo peppers see page 3-372	10 g	2.2%	⑧ Reserve individually.
Salt	as needed		

SOUS VIDE BRAISED SNAILS

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
White chicken stock see page 2·301	600 g	150%	① Vacuum seal together.
Burgundy snails (canned), cleaned	400 g	100%	② Cook sous vide in 68 °C / 154 °F bath for 5 h.
Carrots, peeled and thinly sliced	200 g	50%	③ Drain, and reserve juices.
Sweet onions, thinly sliced	180 g	45%	④ Pick out snail meat, and discard vegetables and aromatics.
Salt	15 g	3.75%	⑤ Vacuum seal snails with reserved juices, and refrigerate.
Thyme	1.5 g	0.4%	
Bay leaf	0.4 g	0.1%	

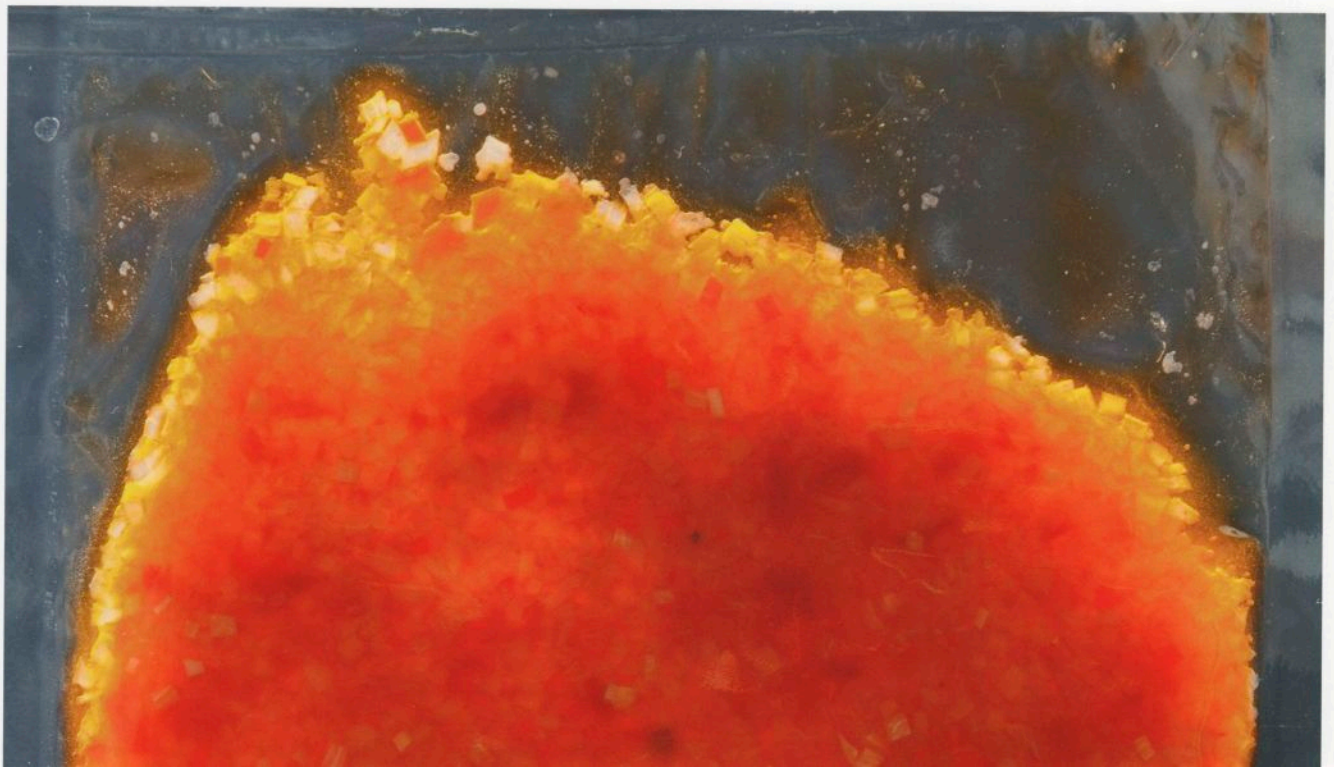
Although we use canned snails for convenience, fresh snails can also be used, as long as they are purged thoroughly before use.

It doesn't take much to start a snail farm, which is why anthropologists believe snails were raised very early on in our ancestry. They are one of the oldest farmed mollusks. Only oysters have been cultivated for longer.

SOFRITO

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Yellow onions, brunoise	100 g	100%	① Sweat over low heat until very tender and sweet, about 30 min.
Olive oil	20 g	20%	
Canned tomatoes, seeded and diced	66 g	66%	② Add to onions, and cook over low heat until vegetables are very tender and all liquid has evaporated, about 30 min.
Tomato juice	66 g (from 150 g tomatoes)	66%	③ Cool.
			④ Refrigerate.
Cubanelle peppers, fine brunoise	33 g	33%	
Garlic cloves, blanched once, brunoise	3.3 g	3.3%	
Sherry vinegar	20 g	20%	⑤ Measure and reserve individually.
Cilantro stems, finely minced	3.3 g	3.3%	
Salt	2 g	2%	



SOUS VIDE ARTICHOKE

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	200 g	200%	① Vacuum seal together.
Baby artichokes, peeled, chokes and tough leaves discarded	100 g (four pieces)	100%	② Cook sous vide in 90 °C / 194 °F bath for 45 min. ③ Cool. ④ Refrigerate.
Yellow onion, thinly sliced	25 g	25%	
Carrot, peeled and thinly sliced	15 g	15%	
Lemon peel	5.5 g	5.5%	
Salt	2.5 g	2.5%	
Ascorbic acid	1 g	1%	
Thyme	1 g	1%	
Black peppercorns	0.5 g	0.5%	
Black coriander seeds	0.5 g	0.5%	
Bay leaf	0.2 g	0.2%	

HORCHATA FOAM

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Chufa nuts	450 g	225%	① Cover nuts with water. ② Soak in refrigerator for 12 h. ③ Drain.
Water	250 g	125%	④ Combine with soaked nuts.
Sugar	16 g	8%	⑤ Blend to smooth, fine texture. ⑥ Pass through fine sieve to extract chufa milk. ⑦ Vacuum seal, and refrigerate until cold.
Chufa milk, cold, from above	200 g	100%	⑧ Disperse soy lecithin and whey protein isolates in milk.
Deoiled soy lecithin	6 g	3%	⑨ Blend thoroughly.
Whey protein isolate	1.4 g	0.7%	
Salt	as needed		⑩ Season chufa milk. ⑪ Vacuum seal, and refrigerate.

If you have visited Spain in the summer, you have probably had a cool glass of sweet *horchata*. But it's made with *chufa*, not almonds, as most people assume. *Chufas*, or tigernuts, have been found in Egyptian tombs and are known for being rich in minerals and amino acids. They were introduced to Valencia by the Moors, and Valencia is still the only place in Europe where the tuber is grown. The word *horchata* comes from *orxata*. Legend has it that James I of Aragon tried the drink and exclaimed, *"Això és or, xata!"* ("That's gold, darling!")

SEARED LANGOUSTINE

Yields 160 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Langoustine tails, peeled	160 g (four tails)	100%	① Refrigerate.
Grapeseed oil	as needed		② Reserve individually.
Salt	to taste		

SOCCARAT TUILE

Yields 170 g (about 24 discs)

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	160 g	160%	① Vacuum seal together.
Bomba rice	100 g	100%	② Cook sous vide in 90 °C / 194 °F bath until very tender, about 45 min.
Olive oil	5 g	5%	③ Puree with cooked rice mixture until smooth.
Salt	2 g	2%	④ Spread puree evenly on silicone baking mat.
Puffed wild rice see page 4-302	50 g	50%	⑤ Sprinkle puree evenly with puffed rice.
			⑥ Bake in 150 °C / 300 °F oven until crisp, about 10 min.
Freeze-dried piquillo pepper, powdered (or sweet paprika) see page 3-372	1 g	1%	⑦ Dust rice crisp with piquillo pepper powder while still warm.
			⑧ Break into desired shapes.
			⑨ Reserve in airtight container.

ASTRONAUT RAMEN

Pork and young ginger

What was Japan's best invention of the 20th century? The Japanese voted for instant ramen. (Karaoke came in second.) Momofuku Ando created Chikin Ramen in 1958, after perfecting a way to flash-fry cooked noodles. They cost six times more than fresh noodles and seemed to be a luxury item doomed to fail. Instead, an increasingly rushed modern workforce vaulted them to success. Next came the pioneering Styrofoam-packaged Cup Noodles with its freeze-dried meats and vegetables. This was real space-age food science in action!

Indeed, Ando's proudest achievement was sending ramen into outer space. He designed a vacuum-packed version, Space Ramen, for the space shuttle Discovery. And that is the inspiration for Astronaut Ramen. Everything in this ramen is freeze-dried: the braised pork shoulder, the pork belly, the enoki mushrooms—even the edible cup. Johnny Zhu spent weeks in our development kitchen fine-tuning the texture of the ramen cup fillings to best replicate the texture of fresh ramen upon rehydration.

YIELD: *four portions*
SPECIAL EQUIPMENT: *freeze dryer, sous vide equipment*
TIME REQUIRED: *22 h overall, including 2 h preparation, and 5 min to finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Ramen Stock see page 2·455	20 min	*1½ h** and *12 h**	45 s	36 g (four portions)
"Styrofoam" Cup and Lid	20 min	*12 h**	45 s	10 g (four cups and lids)
Ramen Noodles	15 min	*12 h**	45 s	20.8 g (four clusters)
Ramen Vegetables see page 2·455	30 min	*2 h** and *12 h**	45 s	4 g hon shimeji (mushrooms) 1.7 g bamboo shoots 0.4 g young ginger 0.4 g carrot 0.4 g scallion greens 1.2 g lotus slices
Freeze-dried Egg Yolk	10 min	*45 min** and *12 h**	45 s	7 g
Freeze-dried Pork	10 min	*8 h** and *12 h**	45 s	50 g

**(unattended times)*

ASSEMBLY:

Place a "Styrofoam" cup in middle of each bowl.
Build up ramen components. Sprinkle powdered ramen stock through sieve. Organize freeze-dried noodles, vegetables, egg yolk discs, and pork into four equal portions. Pack ingredients into each cup as tightly as possible, without breaking cup.
Set filled cups in a warm bowl, and place lids on cups.
Heat 360 g water to **70** °C / **158** °F.

At table:
Pour 90 g water over each covered cup to fully dissolve packaging.
Stir, then allow freeze-dried ingredients to hydrate for at least 45 s before serving.

"STYROFOAM" LID

Yields 2 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water, cold	300 g	100%	① Disperse gelatin in water.
160 Bloom gelatin	9 g	3%	② Heat until dissolved.
			③ Cool mixture to room temperature.
Xanthan gum	0.75 g	0.25%	④ Whisk into gelatin mixture to hydrate.
			⑤ Vacuum seal to remove accumulated bubbles.
			⑥ Spread gelatin mixture on nonstick silicone mat in layer 1 mm / 1/16 in thick.
			⑦ Refrigerate preparation until set, at least 4 h.
			⑧ Outline lids on gel sheet, and form discs by pressing down with ring cutter 7 cm / 2¾ in. in diameter. Leave lid discs outlined on sheet for later removal.
			⑨ Freeze, and freeze-dry for 12 h.
			⑩ Peel away lids from sheet, and reserve in dry place.
			⑪ Store lids in dry environment.

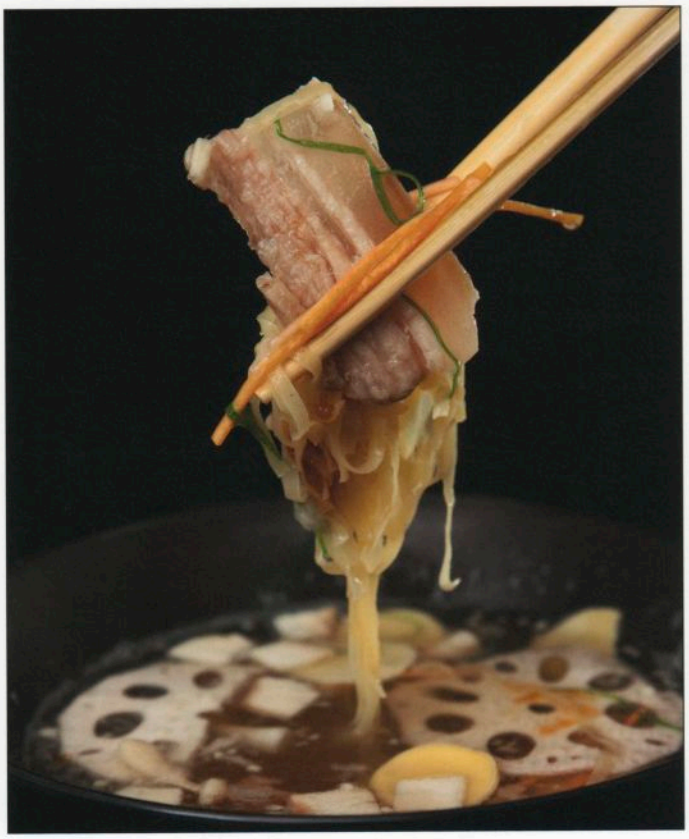
For more on freeze-drying, see page 2·438.

Momofuku Ando invented Cup Noodles in 1971 at age 61, proving it is never too late to develop a new product. The instant-noodle industry has now sold more than 900 billion units—no word yet on what fraction of those was sold to college students.

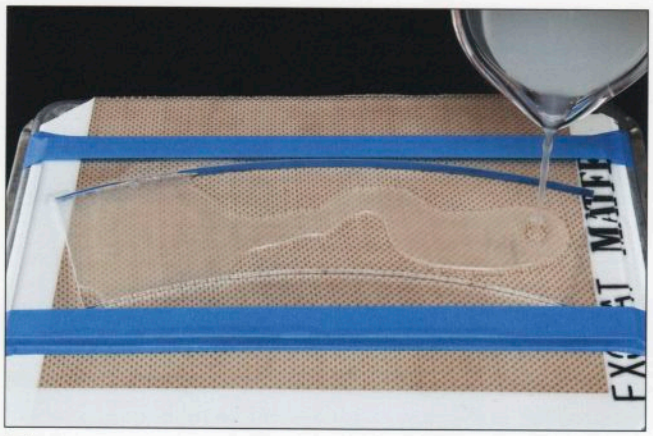
"STYROFOAM" CUP

Yields 8 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water, cold	300 g	100%	① Disperse gelatin in water.
160 Bloom gelatin	9 g	3%	② Heat until dissolved.
			③ Cool mixture to room temperature.
Xanthan gum	0.75 g	0.25%	④ Whisk into gelatin mixture to hydrate.
			⑤ Vacuum seal to remove accumulated bubbles.
			⑥ Using food-grade plastic, make four templates for ramen cups, each measuring 7 cm / 2¾ in diameter at top, 6 cm / 2⅜ in diameter at bottom, 7 mm / 2¾ in tall, and 4 mm / 5/32 in thick.
			⑦ Place cup templates on silicone mat, and spread mixture in layer 3 mm / 1/8 in thick on each of the four templates. Discard excess mixture.
			⑧ Refrigerate preparations until set, at least 4 h.
			⑨ Peel off templates for cups, and reserve.
			⑩ Freeze, and freeze-dry for 12 h.
			⑪ Bring a pot of water to a simmer to make cup material more flexible during cup formation.
			⑫ Hold cup sheet over simmering water, fold edges of sheet carefully to meet, then move away from stove.
			⑬ Brush seams very lightly with water to make edges adhesive.
			⑭ Hold edges together until adhered.
			⑮ Repeat shaping to make three more cups.
			⑯ Store cups in dry environment.



The cup and lid become thickeners that give the broth body.



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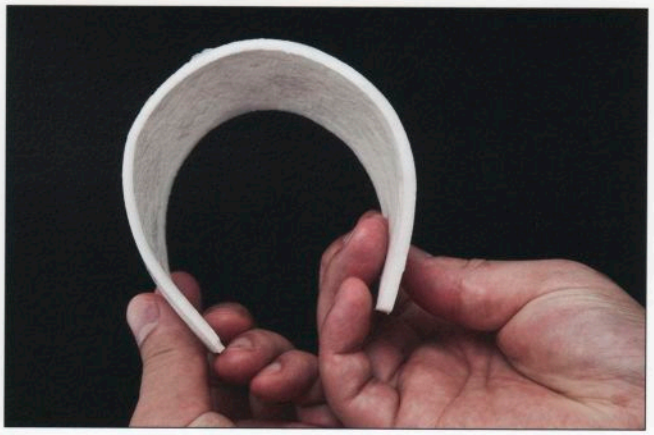

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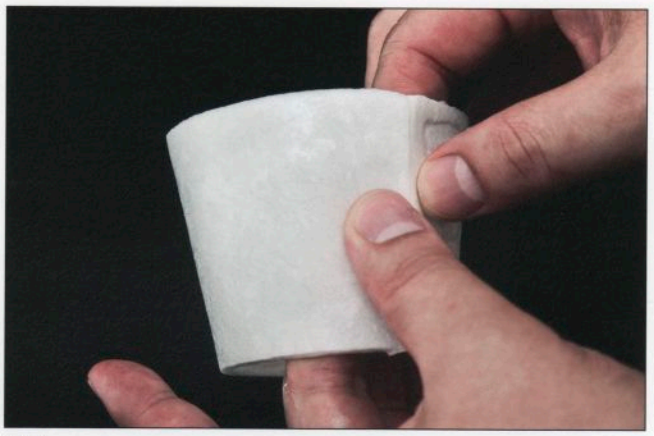

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RAMEN NOODLES

Yields 14.5 g

Unlike many fresh pastas, these noodles take on an al dente texture even when cooked from fresh, thanks to the added gluten in them.

INGREDIENT	QUANTITY	SCALING	PROCEDURE
All-purpose flour	78 g	100%	① Mix together.
Semolina flour	57 g	73%	② Form into mound.
Wheat gluten	2.5 g	3.2%	③ Make well in center.
Salt	1 g	1.3%	
Egg yolks, whisked	76.5 g	98%	④ Pour into well.
Water	17.5 g	22%	⑤ Mix slowly by hand until dough forms.
Neutral oil	14.5 g	18.5%	⑥ Vacuum seal.
			⑦ Rest at room temperature for at least 1 h.
			⑧ Roll with pasta roller into sheets 1 mm / 1/32 in thick.
			⑨ Cut into noodles 2 mm / 1/32 in wide.
			⑩ Form into small clusters; each cluster is one portion.
			⑪ Freeze.
			⑫ Freeze-dry for 12 h.

FREEZE-DRIED EGG YOLK

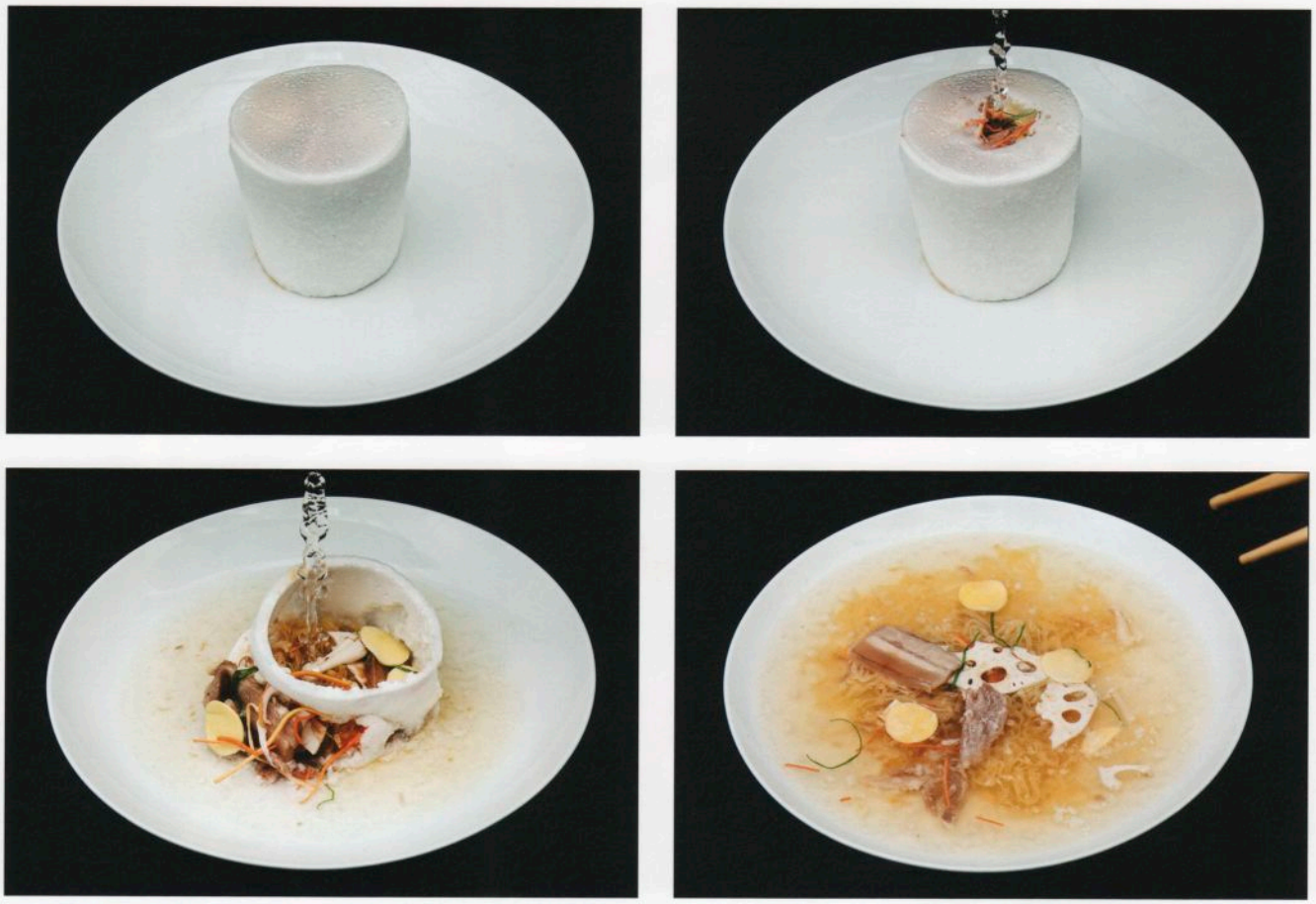
Yields 9 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Eggs	60 g	100%	① Cook in shells in 67 °C / 153 °F bath for 45 min.
			② Cool quickly in ice-water bath.
			③ Crack open, and discard whites.
			④ Roll yolks between two acetate sheets into layer 1 mm / 1/32 in thick.
			⑤ Freeze.
			⑥ Remove top acetate sheet, and punch out small discs with ring cutter 2 cm / 3/4 in. in diameter.
			⑦ Freeze yolk discs. Freeze-dry for 12 h.

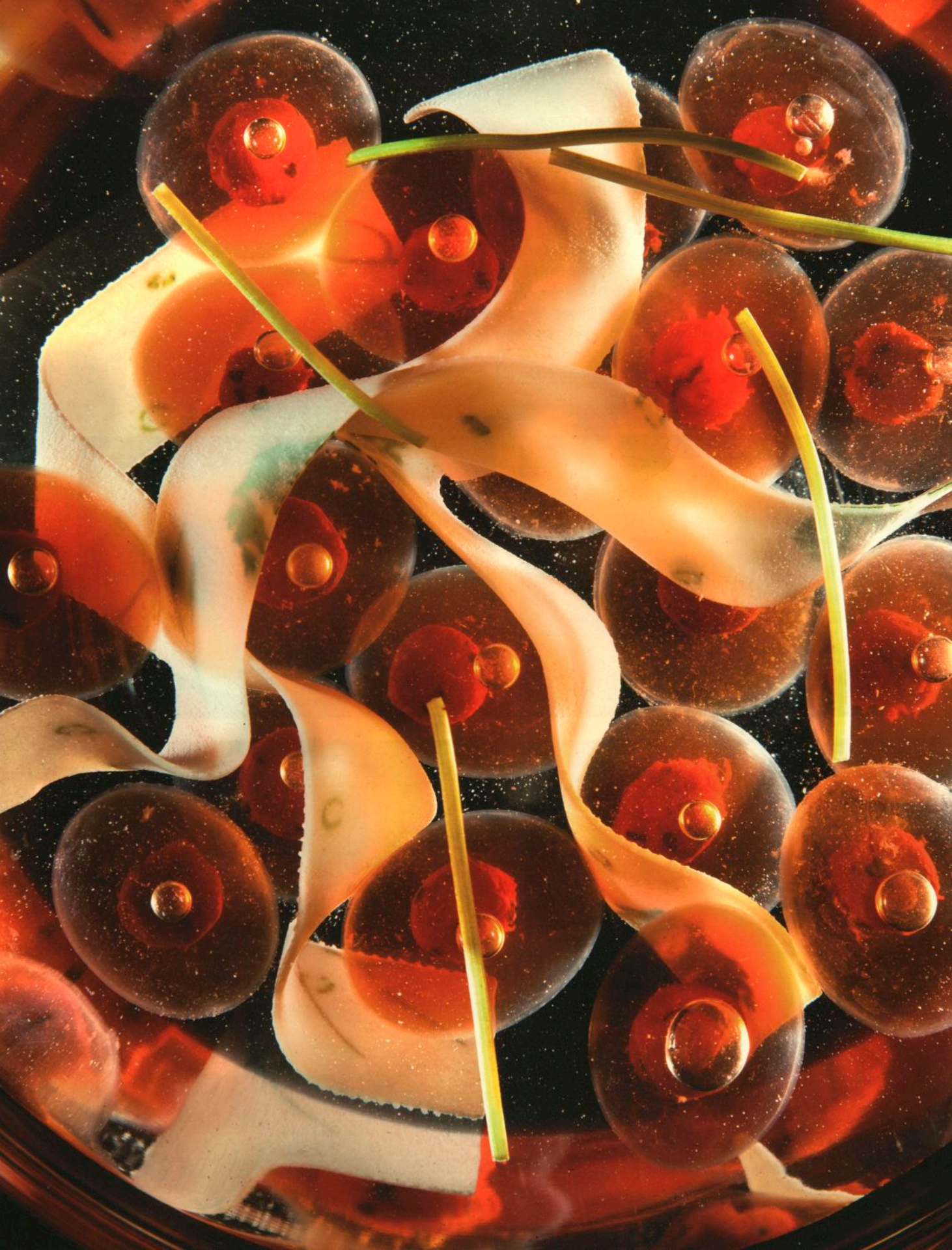
FREEZE-DRIED PORK

Yields 70 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Mangalitsa pork belly, skin on, boneless	100 g	100%	① Vacuum seal. ② Cook sous vide in 82 °C / 180 °F bath for 8 h. ③ Freeze slices. ④ Slice into pieces 1 mm / 1/32 in thick. ⑤ Freeze. ⑥ Freeze-dry for 6 h.
Mangalitsa pork shoulder, boneless	100 g	100%	⑦ Vacuum seal. ⑧ Cook sous vide in 88 °C / 190 °F bath for 8 h. ⑨ Shred into fine strands. ⑩ Cool completely. ⑪ Freeze. ⑫ Freeze-dry for 12 h.



As boiling water is poured into the cup, rehydrating the freeze-dried ramen, the "Styrofoam" melts, leaving only a beautiful plate of soup.



SHANGHAI SOUP DUMPLINGS

Pork and crab juice, toasted sesame seeds, scallion marmalade

The fog billows as the lid of the bamboo basket is lifted. Small, symmetrical dumplings, plump with meat and soup, burst in the mouth at first bite. They're so addictive that people have been known to wander Shanghai in search of the best soup dumplings. *Xiao long bao* first appeared in Nanxiang, outside Shanghai, at least 100 years ago. Traditionally, gelled stock is pureed and folded into the ground pork (and sometimes crab).

This recipe showcases spheres of soup—the liquid is encased in a skin of delicate gel, rather than bundled in dough. We season the soup stock with a small amount of calcium lactate salt, gel it in a mold, then drop it into a solution of alginate, a hydrocolloid derived from seaweed. The two react to form a thin outer layer of alginate around the soup and a marble of crab meat inside. A translucent veil of dough is laid across the top to make a beautiful burst of soup, modernized.

YIELD: *four portions*
SPECIAL EQUIPMENT: *pressure cooker*
TIME REQUIRED: *4 h overall, including 1 h preparation and 7 min to cook and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Triple Dungeness Crab and Pork Stock Infusion		35 min and *1 h**		200 g
Crab and Ginger Marble	5 min	*4 h**		four, 1 g each
Herb-Embedded Pasta Veil see page 3·383	20 min			15 g
Roasted Scallion Marmalade	5 min	5 min	1 min	16 g
Soy Vinegar Infusion	2 min			4 g
Crab and Pork Stock Sphere	20 min		5 min	four, 10 g each
GARNISH				
Chives, finely minced				5 g
Young ginger, fine julienne				5 g

**(unattended times)*

ASSEMBLY:

Warm crab and pork stock spheres in **65** °C / **149** °F bath for 5 min.
Allow to rest for 2 min.

While spheres are resting:
Cook pasta veils in simmering 3% salt water for 1 min.
Divide scallion marmalade among four porcelain spoons, and nestle one hot sphere on top of each portion.

Drape each sphere with one herb-embedded pasta veil, and season with soy vinegar infusion.
Garnish with chives and young ginger.

Both the traditional and modern approaches to making soup dumplings have had to solve the same problem: how to encapsulate soup in a gel coating. The modernist version relies on reverse-molded spherification with sodium alginate. It is visually striking because the alginate, unlike pasta, is transparent.

TRIPLE DUNGENESS CRAB AND PORK STOCK INFUSION

Yields 850 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Dungeness crab, chopped	1.35 kg	135%	① Panfry until golden brown, about 15 min.
Chicken wings, finely chopped	1 kg	100%	② Remove from pan, and reserve.
Ground pork	650 g	65%	
Grapeseed oil	315 g	31.5%	
Scallions, thinly sliced	400 g	40%	③ Add to meat pan, and sauté vegetables until lightly browned.
Carrots, peeled and thinly sliced	280 g	28%	
Leeks, thinly sliced	280 g	28%	
Fennel, thinly sliced	246 g	24.6%	
Shallots, thinly sliced	135 g	13.5%	
Tomato paste	50 g	5%	④ Add to sautéed vegetables, and continue to sauté until golden brown, about 4 min.
Sake	10 g	1%	⑤ Deglaze pan with sake.
Water	1 kg	100%	⑥ Add reserved browned meat and crab, and water.
			⑦ Pressure-cook mixture at a gauge pressure of 1 bar / 15 psi for 1 h.
			⑧ Cool, then strain through fine sieve, yielding about 850 g of stock.
Star anise, lightly crushed	1 g	0.1%	⑨ Bring stock to a boil, and remove from heat.
Cinnamon stick	0.4 g	0.04%	⑩ Add spices, and steep for 1 min.
Black peppercorns	0.3 g	0.03%	⑪ Strain through fine sieve.
Sugar	3 g	0.3%	⑫ Add sugar to stock infusion.
			⑬ Cool.
			⑭ Vacuum seal, and refrigerate.

A delicate noodle veil is laid atop the soup-dumpling sphere.

CRAB AND GINGER MARBLE

Yields 20 g (20 marbles)

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Steamed crabmeat	20 g	100%	① Mix together thoroughly.
Chives, finely minced	1 g	5%	
Young ginger, brunoise	1 g	5%	
Salt	0.5 g	2.5%	
Sesame oil powder (store-bought)	0.4 g	2%	
Activa RM	0.3 g	1.5%	② Sprinkle lightly over crabmeat mixture.
			③ Mix to incorporate.
			④ Form into 1 g balls, each 1 cm / ⅜ in. in diameter.
			⑤ Refrigerate for at least 4 h to allow enzyme to bind.

ROASTED SCALLION MARMALADE

Yields 90 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Scallions, thinly sliced	100 g	100%	① Sauté scallions in oil until golden, about 5 min.
Grapeseed oil	5 g	5%	
Salt	1 g	1%	② Season scallions.
			③ Refrigerate.

SOY VINEGAR INFUSION

Yields 50 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Rice vinegar	25 g	250%	① Combine.
Soy sauce	10 g	100%	② Taste for balance, and adjust seasoning if necessary.
Chives, finely minced	1.8 g	18%	③ Refrigerate.
Young ginger, brunoise	1.8 g	18%	
Ginger oil	0.5 g	5%	
Palm sugar	0.3 g	3%	
Toasted sesame oil	0.2 g	2%	

CRAB AND PORK STOCK SPHERES

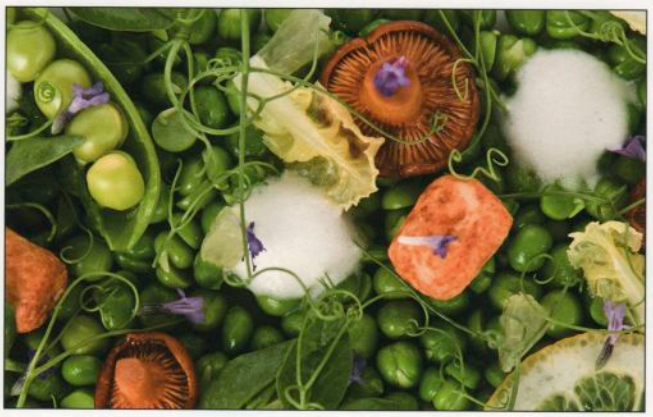
Yields 240 g (24 spheres)

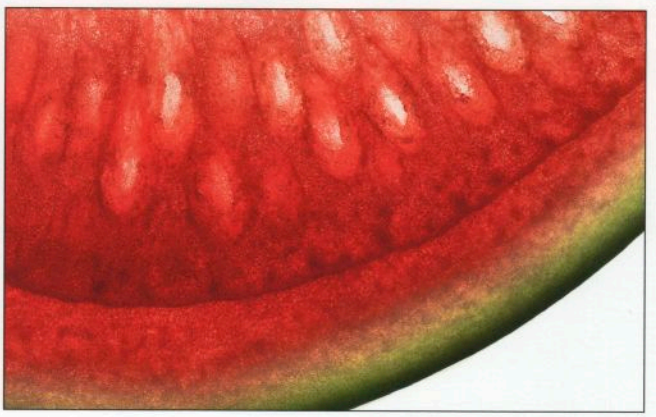
INGREDIENT	QUANTITY	SCALING	PROCEDURE
For the spheres:			
Triple crab and pork stock infusion, cold, from above	200 g	100%	① Disperse calcium lactate in stock. ② Vacuum seal to remove excess air.
Calcium lactate	6 g	3%	③ Refrigerate.
Crab marbles, from above	20 g (20 marbles)	10%	④ Pour stock solution into 20 hemisphere silicone molds, each 3 cm / 1¼ in. in diameter. ⑤ Delicately place one crab marble in center of each hemisphere. ⑥ Press crab marble into fluid until centered. Stock should be viscous enough to suspend marble in core of hemisphere. ⑦ Freeze.
For the setting bath:			
Water, cold	500 g	100%	⑧ Disperse sodium alginate in water.
Sodium alginate (Algin, Texturas brand)	2.5 g	0.5%	⑨ Vacuum seal to remove excess air. ⑩ Pour solution gently into pot and heat to **60–65** °C / **140–149** °F. ⑪ Remove from heat, and carefully drop in frozen hemispheres. ⑫ Leave for 2 min; as the hemispheres melt, they will become spheres. Turn spheres over, and leave for 1 min longer. ⑬ Fill two bowls with warm water, each heated to **75–80** °C / **167–176** °F, and fill a third with cold water. ⑭ Using slotted spoon, transfer spheres to first bowl of heated water to rinse for 1 min. ⑮ Transfer spheres to second bowl of heated water to rinse again, and then hold spheres in bowl of cold water, refrigerated.

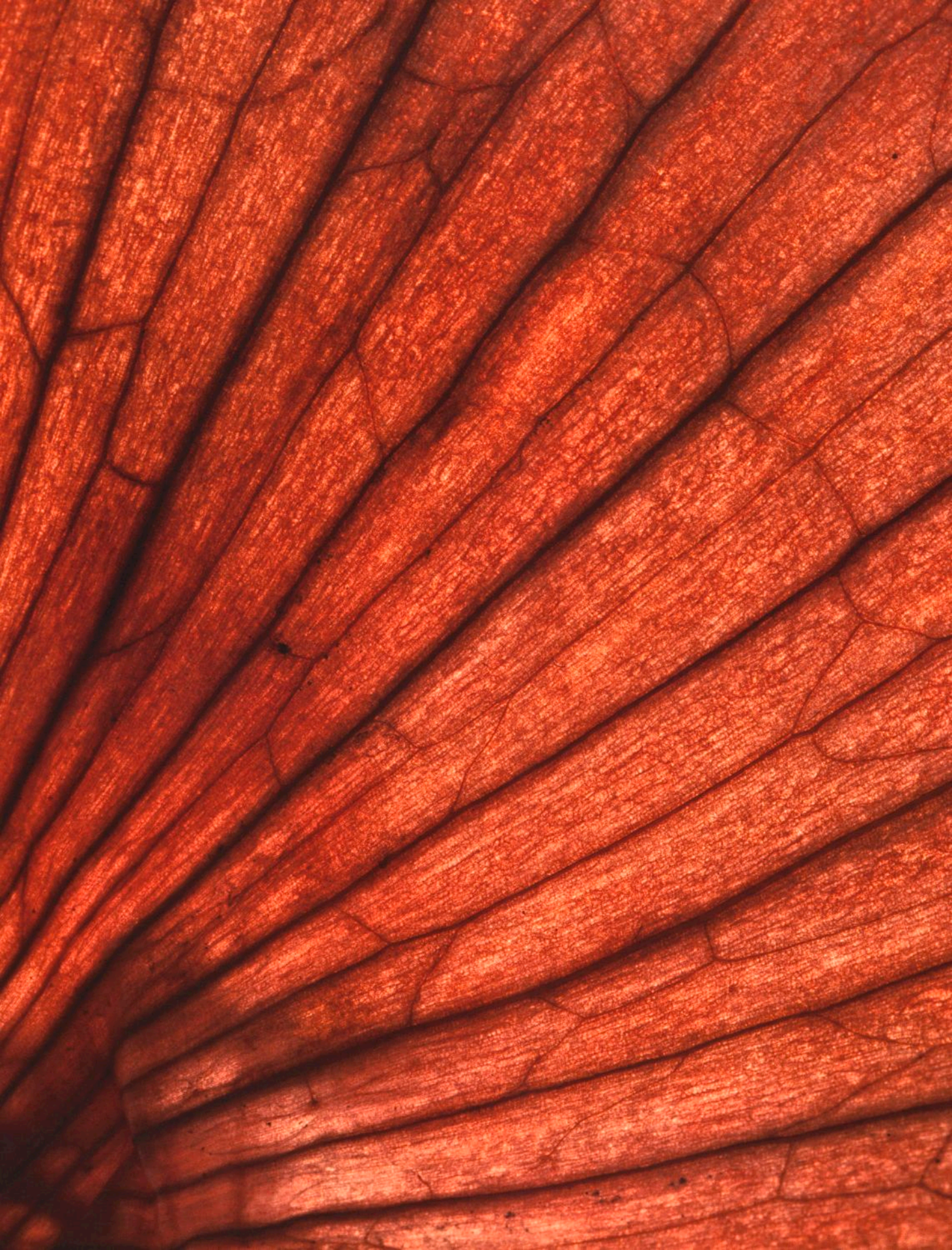
Spherification was first used in 1942, to create artificial cherries. In 2003, Ferran Adrià of elBulli wowed the restaurant industry with the technique by presenting orbs of pea puree. Since then, the technique has grown in popularity.

Numerous grades of sodium alginate are available, each with varying properties. This recipe was developed with the Texturas brand alginate.

FRUITS AND VEGETABLES







ONION TART INSPIRED BY PIERRE HERMÉ

Gruyère custard, onion arlette, onion gratin

In this tart, savory is sweet, and sweet is savory; the gratin is on the bottom, and the onion sablé "crust" is on the top. It's upside down and unexpected, a Modernist reinvention of a time-honored classic.

We drew inspiration for this dish from pastry chef Pierre Hermé, who is famous for savory yet sweet concoctions like macaroons of white chocolate and green olive, or raspberry and red pepper, as well as for plated desserts composed of avocado, banana, and chocolate. The sweet potential of onions made perfect sense to us as a bridge for what has become, in Modernist cooking, a gray area between sweet and savory. We also drew inspiration from the structural complexity of Hermé's desserts, another of his signature contributions to the pastry world. The contrasting textures of the onion arlette, sable, gratin, and the Gruyère custard make this interpretation of the onion tart truly unique.

Its onion gratin was inspired by chef Alain Passard of L'Arpège. He softens the onions slowly over a low flame so that they never caramelize and flavors them with copious amounts of dry Gewürztraminer wine, aged Parmigiano-Reggiano, and lemon zest.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, meat slicer*
OPTIONAL EQUIPMENT: *freeze dryer*
TIME REQUIRED: *3 h overall (12 h if making Freeze-dried Onion Powder), including 50 min preparation and 15 min to reheat and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Onion Arlette	20 min	30 min and *1 h**		16 slices, 10 g each
Freeze-dried Onion Powder optional, see page 3·373	5 min	30 min and *12 h**		8 g
Onion Sablé	10 min	2¼ h		150 g
Glazed Pearl Onion	5 min	*1 h**	3 min	50 g
Onion Stock	5 min	15 min and *1 h**		375 g
Gruyère Custard	10 min	40 min	8 min	80 g
Onion Gratin	10 min	45 min	5 min	60 g
GARNISH				
Chive blossoms				12
Lime zest, grated				to taste

**(unattended times)*

ASSEMBLY:

Heat onion custard cubes in **70** °C / **160** °F oven until just warmed through, about 8 min.

While custard is heating:

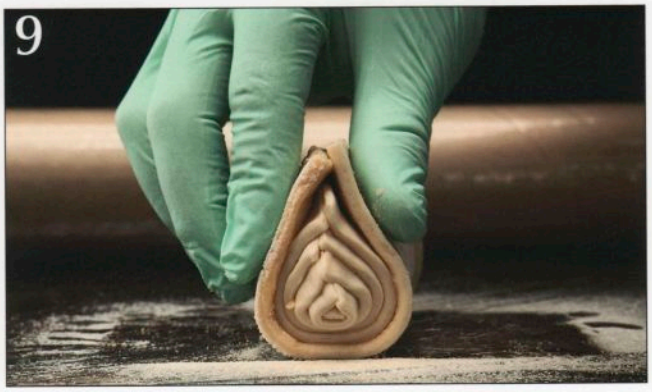
Set each portion of onion gratin on center of heatproof plate, and broil until warmed through and golden, about 5 min.

Drain pearl onions, cut in half through stem end, and pat dry.

Sear pearl onions in oil, cut side only, until surfaces are golden and onions are just warmed, about 3 min.

Top each gratin with three custard cubes and a sablé rectangle.

Garnish each plate with five seared onion halves, three onion arlettes, three chive blossoms, and lime zest.



Rectangular pieces of dough in increasing sizes combine to make onion-like shapes in the Onion Arlette.

For more on juicing methods, see page 2:332.

ONION ARLETTE

Yields 500 g

INGREDIENT	QUANTITY	SCALING
Sweet onion juice	300 g (from about 500 g onions)	100%
Trehalose (or isomalt or sugar)	130 g	43.3%
Glucose syrup DE40	70 g	23.3%
Puff pastry dough (store-bought or fresh-made)	500 g	167%
Clarified unsalted butter, melted	150 g	50%

PROCEDURE

① Combine, and cook at 155 °C / 310 °F, until a light golden caramel forms.
② Pour hot onion syrup onto silicone mat.
③ Cool and harden at room temperature, about 20 min.
④ Grind to fine powder.
⑤ Reserve onion sugar.
⑥ Roll out dough in rectangle 0.5 cm / ¼ in thick.
⑦ Cut dough into five progressively smaller rectangles.
⑧ Stack in layers, brushing with butter and dusting with a thin coat of onion sugar between each layer.
⑨ Fold and roll dough into cylinder, and then pinch top to give dough a bulb shape.
⑩ Freeze until very hard, about 45 min.
⑪ Cut dough with meat slicer to slices 1 mm / 1/16 in thick.
⑫ Place slices between two silicone mats, and pass rolling pin over top until slices are nearly translucent; they should retain their shape.
⑬ Dust flattened slices with more onion sugar to fully coat surfaces.
⑭ Transfer to silicone mat–lined baking sheet.
⑮ Bake in 170 °C / 340 °F oven for 7 min.
⑯ Dust with additional onion sugar, and bake for 2–3 min.
⑰ Cool, and reserve in cool, dry place.

ONION SABLÉ

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Unsalted butter	500 g	500%	① Simmer over low heat for 2 h to infuse butter with onion flavor, being careful not to brown onions.
Sweet onions, thinly sliced	200 g	200%	② Strain butter, and reserve onions for other use.
			③ Measure 100 g of onion broth for making dough.
All-purpose flour	112.5 g	112.5%	④ Mix to form dough, and rest dough for 20 min at room temp.
Onion butter, from above	100 g	100%	
Almond powder	50 g	50%	⑤ Roll out dough 1 mm / 1/16 in thick.
Isomalt	50 g	50%	⑥ Place on nonstick baking sheet.
Egg yolk, cooked sous vide in 65 °C / 149 °F bath for 7 min	25 g	25%	⑦ Bake in 175 °C / 350 °F oven until lightly golden, about 11 min.
Cornstarch	12.5 g	12.5%	⑧ Cut into 3 cm by 8 cm / 1¼ in by 3¼ in rectangles while still warm.
Freeze-dried onion powder see page 3·373	8 g	8%	⑨ Cool completely.
Salt	4.5 g	4.5%	⑩ Reserve in cool, dry place.
Heavy cream	3.3 g	3.3%	
Baking powder	1.5 g	1.5%	

Freeze-dried onions can be found in some supermarkets. They can be ground to a fine powder and substituted for the homemade freeze-dried onions in this recipe.

GLAZED PEARL ONION

Yields 230 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pearl onions, blanched, shocked, and peeled	100 g	111%	① Prepare onions as directed.
			② Vacuum seal onions with other ingredients.
Water	90 g	100%	③ Cook sous vide in 85 °C / 185 °F bath for 1 h.
Champagne vinegar	30 g	33%	④ Cool in ice-water bath.
Honey	7 g	8%	⑤ Refrigerate.
Salt	3 g	3.5%	
Neutral oil	as needed		

ONION STOCK

Yields 650 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, thinly sliced	400 g	100%	① Sauté onions in butter over medium-high heat, stirring frequently until golden, about 15 min.
Clarified unsalted butter	50 g	12.5%	
Water	500 g	125%	② Simmer with sautéed onions for 1 h.
Vermouth (dry)	30 g	7.5%	③ Strain.
			④ Cool stock.
			⑤ Reserve 175 g of stock for Gruyère custard and 200 g for onion gratin.

GRUYÈRE CUSTARD

Yields 670 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk	250 g	250%	① Combine.
Heavy cream	75 g	75%	② Bring to simmer.
Sodium citrate	4.7 g	4.7% *(0.78%)**	
Gruyère cheese, grated	100 g	100%	③ Blend into milk mixture, stirring until melted and smooth.
			④ Set aside creamy cheese mixture.
Sweet onions, thinly sliced	50 g	50%	⑤ Sauté onions until tender, about 30 min.
Unsalted butter	20 g	20%	⑥ Cool.
			⑦ Hand-blend into cheese mixture.
			⑧ Pass through fine sieve.
			⑨ Cool completely.
Onion stock, from above	175 g	175%	⑩ Disperse carrageenans in cold stock.
Iota carrageenan	3.35 g	3.35% *(0.5%)**	⑪ Blend with cooled cheese mixture.
			⑫ Heat to 95 °C / 203 °F for 3 min to fully hydrate.
Kappa carrageenan	1.35 g	1.35% *(0.2%)**	
Salt	to taste		⑬ Season stock mixture.
			⑭ Cast evenly into mold to create a layer 2.5 cm / 1 in thick.
			⑮ Refrigerate until set, about 10 min.
			⑯ Cut into 2.5 cm / 1 in cubes.
			⑰ Refrigerate.

**(% of total weight of all other ingredients)*

The components of this recipe can be plated and served in many different ways to suit the look you want to achieve and the textures you want to emphasize.

ONION GRATIN INSPIRED BY ALAIN PASSARD

Yields 250 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet onions, very thinly sliced	250 g	100%	① Sauté onions in butter over low heat until translucent but not colored, about 40 min.
Clarified unsalted butter	20 g	8%	
Gewürztraminer (dry)	200 g	80%	② Deglaze onions with wine and stock until onions are completely cooked and very tender, and all liquid has evaporated, about 45 min.
Onion stock, from above	200 g	80%	
Parmesan cheese, finely grated	25 g	10%	③ Season onion mixture.
			④ Cool.
Black pepper, finely crushed	0.3 g	0.12%	⑤ Spread onto silicone baking sheet in even layer 1 cm / ½ in thick.
Lemon zest, finely grated	0.25 g	0.1%	⑥ Refrigerate for at least 1 h, until fully hardened.
Salt	to taste		⑦ Cut into 5 cm by 10 cm / 2 in by 4 in rectangles.
			⑧ Refrigerate.

LENTIL SALAD

Foie gras parfait, pickled Bing cherry, hazelnut nougatine, chamomile

Many people have a dim view of lentils, as the legume is usually boiled into oblivion. Cooked with care, lentils—particularly delicate French green lentils, or *lentilles vertes du Puy*—will have a creamy texture.

Lentils take to their surroundings, so they are a good canvas on which to layer flavor. Our summer salad folds a cherry vinaigrette into chilled lentils. Chopped, pickled Bing cherries add a bright burst of acidity.

Including foie gras is a classic French touch of mixing the pedestrian and extravagant. Dipping the foie gras in cherry gelée to fashion it as a faux cherry is a nod to chef Paul Liebrandt. A stem makes it literally the cherry on top.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, gas blowtorch, silicone hemisphere molds, vacuum reduction equipment*
OPTIONAL EQUIPMENT: *liquid nitrogen*
TIME REQUIRED: *11 h overall, including 2½ h preparation and 5 min to finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
White Duck Stock see page 2·301	20 min	*1½ h**		170 g
Foie Gras Parfait	30 min and *5 h**	20 min and *3 h**		
Foie Gras Cherry	20 min		2 min	four
Pickled Bing Cherry	10 min	*2 h**		25 g
Dried Cherry and Hazelnut Nougatine	30 min	5 min		40 g
Cherry Vinaigrette	5 min			175 g
Sherry Gel Cube	2 min	10 min		10 g
Sous Vide Lentils	10 min	*2 h**	3 min	350 g

**(unattended times)*

ASSEMBLY:

Place foie gras cherries on nonstick baking sheet, and let come to room temperature, about 10 min, before serving.
Drain cooked and cooled lentils, and dress with cherry vinaigrette.
Fold in each component—minced pickled cherries, sherry gel cubes, green hazelnut slices, diced radish, and chervil tops—into dressed lentils.
Spoon lentil salad equally into four bowls.
Arrange one foie gras cherry on top of each salad.
Finish with chamomile blossoms, frisée tops, and shards of nougatine.

This recipe makes more foie gras parfait than is needed for the molded cherries. Luckily, it is delicious with just about anything, or on its own. Omitting the parfait, however, greatly simplifies this recipe, and reduces the overall preparation and cooking time to about 2 h, mostly unattended, while the lentils cook.

We use curing salts to maintain the original pink color of the foie gras parfait. The salts prevent the graying that otherwise occurs. For more on using curing salts, see page 3·152.

FOIE GRAS PARFAIT

Yields 600 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Raw duck foie gras	425 g	100%	① Slice 1 cm / ⅜ in off each end of lobe.
Whole milk	as needed		② Cover foie gras with milk, soak for 5 h in refrigerator to drain blood, then drain and vacuum seal.
			③ Cook sous vide in 57 °C / 135 °F bath to core temperature of 56 °C / 133 °F, about 20 min.
White duck stock see page 2·301	170 g	40%	④ Disperse gelatin in small amount of stock, and heat until fully dissolved.
160 Bloom gelatin	10 g	2.4%	⑤ Whisk into remaining stock.
Insta Cure No. 1	6 g	1.4%	⑥ Blend foie gras with gelatin mixture and remaining ingredients.
Salt	6 g	1.4%	⑦ Pipe 12 g of mixture into each of 36 silicone hemisphere molds, each 2.5 cm / 1 in. in diameter.
Sugar	3 g	0.7%	⑧ Refrigerate for at least 4 h to set.
			⑨ Melt flat surface of each still-molded foie gras hemisphere with blowtorch.
			⑩ Place half of hemispheres on top of remaining hemispheres to create spheres.
			⑪ Insert 10 cm / 4 in skewer into each foie gras sphere.
			⑫ Freeze spheres with liquid nitrogen, if available, or in freezer.

FOIE GRAS CHERRIES

Yields 150 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sour cherry juice	150 g	100%	① Disperse gellan gum into cold juice. Bring to a boil.
Low-acyl gellan (Kelcogel F, CP Kelko brand)	1.5 g	1% (*0.26%*)	② Pour liquid into beaker set in ice-water bath.
			③ Blend mixture with immersion blender as it sets to form fluid gel, and set aside.
Cherry pickling brine, from below	85 g	57%	④ Disperse gelatin in small amount of brine.
			⑤ Heat mixture until gelatin is fully dissolved.
160 Bloom gelatin	14 g	9.3% (*2.4%*)	⑥ Blend gelatin mixture with remaining ingredients.
			⑦ Whisk in the prepared sour-cherry fluid gel from above.
Black cherry puree	200 g	133%	
Amarena cherry syrup	150 g	100%	⑧ Vacuum seal to remove accumulated air bubbles.
Xanthan gum	0.6 g	0.4% (*0.07%*)	
Foie gras parfait, from above	100 g (four spheres)	67%	⑨ Dip frozen foie gras spheres into cherry liquid, coating evenly.
			⑩ Refrigerate until set, about 1 h.

**(% of total weight of all other ingredients except foie gras)*

PICKLED BING CHERRY

Yields 650 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Bing cherries	500 g	100%	① Arrange in single layer in rigid plastic container that fits in vacuum sealer chamber.
Red wine vinegar	265 g	53%	② Bring all ingredients to a boil to make brine.
Sour cherry juice (store-bought)	150 g	30%	③ Pour brine over cherries, and let cool.
			④ Pull full vacuum three times on cooled cherries.
Sugar	130 g	26%	⑤ Vacuum seal, and refrigerate.
Water	130 g	26%	⑥ Remove 15 cherries, pit them, and mince finely.
			⑦ Reserve for foie gras cherries and cherry vinaigrette.

For more on the steps involved in vacuum infusion, see page 3·390.

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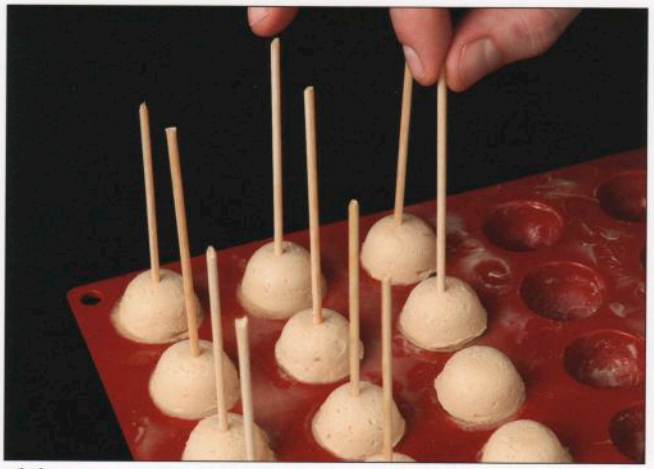

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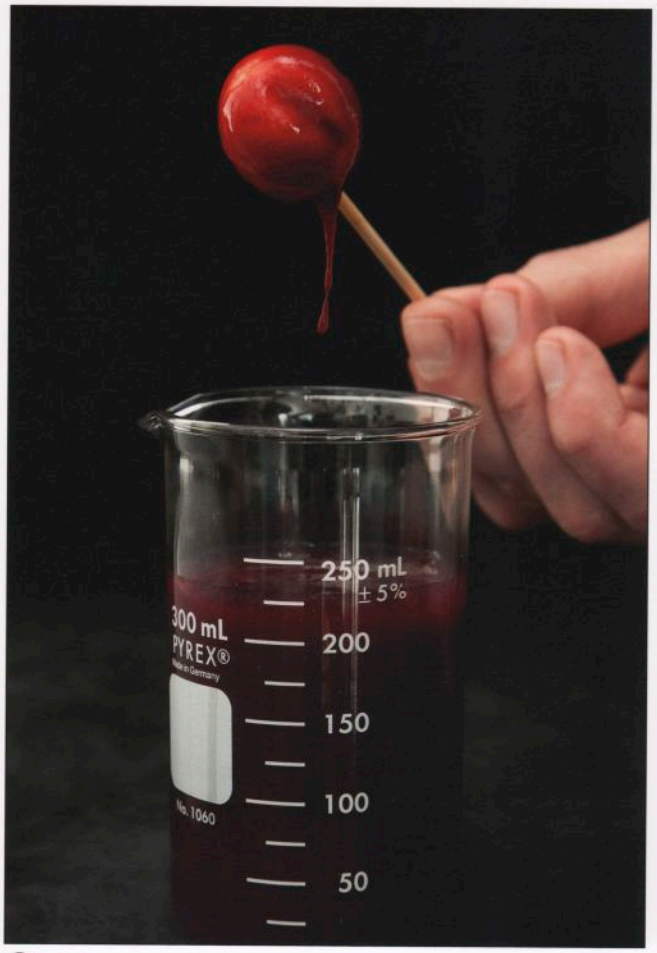
The steps shown above illustrate the Foie Gras Parfait recipe (top recipe on previous page).

The steps shown below illustrate the Foie Gras Cherries recipe (middle recipe on previous page). For a complete step-by-step procedure, see page 4·186.



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DRIED CHERRY AND HAZELNUT NOUGATINE

Yields 240 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sugar	50 g	100%	① Heat together to 150 °C / 300 °F to form syrup.
Trehalose (or isomalt)	50 g	100%	
Glucose syrup DE40	25 g	50%	
Water	20 g	40%	
Hazelnut butter	50 g	100%	② Whisk into syrup, and heat to 170 °C / 340 °F.
Unsalted butter	10 g	20%	
Dried sour cherries, minced	20 g	40%	③ Fold into syrup.
Hazelnuts, peeled and minced	15 g	30%	④ Pour hot mixture onto silicone mat. Cover with second silicone mat, and roll out into layer 1 mm / 1/16 in thick.
Salt	2.2 g	4.4%	⑤ Cool until brittle, break into irregular shards, and store in cool, dry place.
Baking powder	1.5 g	3%	

For more on making nut butters, see page 2·418.

Peaches or apricots are both excellent substitutes for cherries in this salad. Use the stone fruit of your choice in different forms—fresh, dried, pickled, and pureed—to add layers of texture and flavor.

CHERRY VINAIGRETTE

Yields 400 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Black cherry puree	90 g	100%	① Whisk together.
Cherry pickling brine, from above	70 g	78%	
Champagne vinegar	30 g	33%	
Dijon mustard	25 g	28%	
Xanthan gum	0.4 g	0.44%	
Roasted-hazelnut oil	105 g	117%	② Blend oils into vinaigrette base until emulsified.
Extra-virgin olive oil	70 g	78%	
Chamomile essential oil	0.3 g	0.01%	
Salt	4.3 g	4.75%	③ Season and refrigerate.

SHERRY GEL CUBE

Yields 215 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	50 g	33%	① Steep blossoms in 70 °C / 158 °F water for 10 min.
Chamomile blossoms	15 g	10%	② Strain and cool.
Agar	2 g	1.3%	③ Disperse agar in cool chamomile tea.
Sherry vinegar	150 g	100%	④ Mix into chamomile base, and bring to a boil.
			⑤ Pour quickly through fine sieve into desired mold, and let set for 5 min.
			⑥ Cut into 3 mm / 1/8 in cubes, and refrigerate.

SOUS VIDE LENTILS

Yields 650 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Carrots, thinly sliced	120 g	34%	① Wrap aromatics in sachet.
Celery, thinly sliced	50 g	14%	
Sweet onions, thinly sliced	120 g	34%	
Shallots, thinly sliced	80 g	23%	
Leeks, thinly sliced	70 g	20%	
Garlic, thinly sliced	25 g	7%	
Thyme sprig	3 g	0.8%	
Bay leaf	2 g	0.6%	
Black peppercorns	2 g	0.6%	
Distilled water	1 kg	286%	② Combine with sachet, and cook sous vide in **90** °C / **194** °F bath for 1 h 15 min.
French green lentils, soaked in cold water for 2 h	350 g	100%	③ Rest for 30 min at room temperature.
Salt	17 g	4.8%	④ Cool in ice-water bath, and refrigerate.
Green hazelnuts, thinly sliced	90 g	26%	⑤ Measure and reserve individually.
Black radish, small dice	15 g	4%	
Chervil tops	15 g	4%	
Frisée tops	15 g	4%	
Chamomile blossoms (fresh)	5 g	1.5%	

Take care with the cooking water. If you use hard water, the lentils won't cook through; the calcium in hard water reinforces the plant tissue (see page 3·273). The same is true if the water is too acidic. If it is too alkaline, the plant tissue dissolves too readily, and the lentils turn to mush. We prefer distilled water.

Why do lentils split? Because the seed coat softens faster than the center. Presoaking dried lentils helps alleviate this problem by rehydrating both layers more slowly and evenly. Split lentils don't reward you with a burst of texture and flavor when eaten, so take the time to presoak.

SWEET PEA FRICASSEE

Crispy goat's milk, young ginger, cinnamon, sweet pea velouté

White meat stewed in its own juices, coated in a roux-thickened cream or sauce—fricassée is classic French cuisine. In time, the word, which is likely Old French (*fricasser* from *frire*, "to fry,"and *casser*, "to break, cut up"), became a catch-all term for nearly all stewed meat dishes.

In the 1970s, chefs began to shed heavy sauces in favor of freshness and lightness. They were able to redefine fricassée, and so have we. This is our light, vegetarian, springtime version.

We warm sweet garden peas, but not too much. If you heat them just above 70 °C / 158 °F, their delicate flavor turns from "garden" to "cooked." The result is a bright, vibrant broth of pea juice, cinnamon, and lime. Although this light stew of fresh green peas dressed with their own juice is a far cry from a true fricassée, you can see the lineage.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*dehydrator*
OPTIONAL EQUIPMENT:	*centrifuge*
TIME REQUIRED:	*2 h overall, including 1 h preparation and 50 min to assemble and finish*

ORDER OF PREPARATION:

COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Crispy Goat's Milk Ricotta Dumpling	15 min		*45 min** and 2 min	250 g
Cinnamon-Scented Pea Juice	15 min	*1 h**		192 g
Sweet Pea and Young Ginger Fricassee	5 min		2 min	80 g
Pickled Lemon	15 min			8 g
Pea Vine Salad	5 min		1 min	100 g
GARNISH				
Pea blossoms, picked				12
Pea tendrils, picked				12
Young ginger, small matchsticks				12

**(unattended times)*

ASSEMBLY:

Dehydrate ricotta dumplings at **45** °C / **115** °F for 45 min.

Heat oil for frying dumplings to **195** °C / **385** °F.

While oil is heating:

Warm sweet peas and butter lettuce briefly in grapeseed oil.

Season fricassee with lemon zest, young ginger, and salt.

To finish:

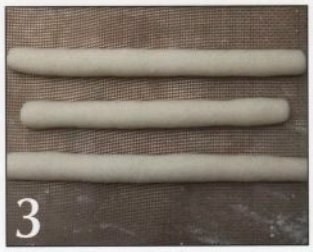
Toss together ingredients and vinaigrette for pea vine salad.

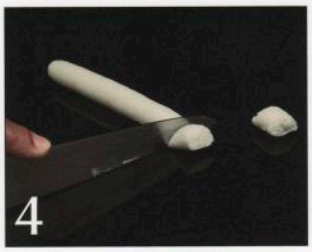
Deep-fry ricotta dumplings until crispy and golden, about 1 min. Drain on paper towels.

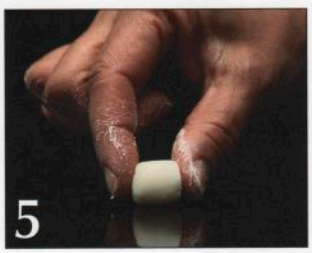
Arrange sweet pea fricassee on each plate.

Garnish with salad, pea blossoms, pea tendrils, young ginger, and dumplings.

Finish with pea juice velouté at table.







CRISPY GOAT'S MILK RICOTTA DUMPLING

Yields 290 g

ADAPTED FROM WYLIE DUFRESNE

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Goat's milk ricotta or cow's milk ricotta store-bought or see page 4-108	200 g	100%	① Blend together fully.
Heavy cream	80 g	40%	
Salt	1.2 g	0.6%	
Black pepper	0.5 g	0.25%	
Ultra-Tex 4 (National Starch brand)	8 g	4% *(3%)**	② Fold into ricotta mixture. ③ Roll into logs 3 cm / 2¼ in. in diameter on nonstick surface, using palms. ④ Cut logs crosswise into 3 cm / 2¼ in pieces. ⑤ Arrange pieces on nonstick baking sheet. ⑥ Refrigerate.
Frying oil	as needed		⑦ Reserve for service.

**(% of total weight of goat's milk ricotta and heavy cream)*

CINNAMON-SCENTED PEA JUICE

Yields 210 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet peas, frozen and juiced	200 g	100%	① Whisk together.
Cinnamon essential oil (optional)	0.05 g	0.025%	② Centrifuge at 27,500*g* for 1 h. ③ Strain.
Lime juice	to taste		④ Season broth.
Salt	to taste		⑤ Refrigerate.

For more on centrifuging and alternative methods of clarification, including step-by-step procedures, see page 2·364.

SWEET PEA AND YOUNG GINGER FRICASSEE

Yields 90 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Sweet peas	80 g	100%	① Vacuum seal. ② Cook at 70 °C / 158 °F for 18 min.
Butter lettuce, small leaves only	10 g	12.5%	③ Measure and reserve individually.
Grapeseed oil	3 g	3.75%	
Lemon zest, finely grated	0.2 g	0.25%	
Young ginger, brunoise	0.2 g	0.25%	
Salt	to taste		

PICKLED LEMON

Yields 125 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Lemons	100 g	100%	① Slice 1 mm / 1/16 in thick. ② Place in rigid container and reserve.
Water	100 g	100%	③ Combine.
White wine vinegar	50 g	50%	④ Bring to a simmer to dissolve sugar.
Sugar	25 g	25%	⑤ Pour warm brine over lemon slices. ⑥ Cool. ⑦ Vacuum seal, and refrigerate.

PEA VINE SALAD

Yields 200 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Pea vines, tips only	120 g	100%	① Measure and reserve individually.
Pickled lemons, from above, drained	36 g	30%	
Cinnamon basil leaves	15 small		
Lemon-infused olive oil	30 g	25%	② Whisk together to form vinaigrette.
Vermouth vinegar	10 g	8.3%	③ Refrigerate.
Lime juice	5 g	4.2%	
Microcrystalline cellulose (optional; Avicel CG200, FMC BioPolymer brand)	0.3 g	0.25% (*0.85%*)*	
Black pepper	to taste		
Salt	to taste		

**(% of total weight of first three ingredients for vinaigrette)*

STRAWBERRY GAZPACHO INSPIRED BY DAVID KINCH

Green strawberry, piquillo pepper, oxalis, macadamia nut oil

Gazpacho, the chilled soup most of us think of as defined by tomatoes, is older than the European arrival of the tomato in the 16th century. The Moors brought the soup to Andalusia during the 8th century. Their variant was known as *ajo blanco* and called for stale bread pounded with garlic, oil, and water.

One excellent adaptation comes from chef David Kinch at Manresa in Los Gatos, California. In most recipes for gazpacho, the tomato nicely balances sweetness with acidity; why not, he thought, use another fruit with similar qualities? Strawberry gazpacho is now one of his signature dishes. One our chefs, Sam Fahey-Burke, made a refreshing sour rhubarb sorbet as a subtle complement to the gazpacho, reinvigorating rhubarb's affinity for strawberries.

YIELD: *four portions*
SPECIAL EQUIPMENT: *Pacojet or ice cream maker*
OPTIONAL EQUIPMENT: *centrifuge, freeze dryer*
TIME REQUIRED: *13 h preparation, including 50 min preparation and 5 min to finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Freeze-Dried Strawberry Powder **store-bought or see page 3·372**	2 min	*12 h**		12 g
Strawberry Consommé	2 min	*2 h**		65 g
Strawberry Gazpacho	20 min	*12 h**		300 g
Piquillo Pepper and Strawberry Salad	20 min		1 min	80 g
Seared Strawberry	5 min		2 min	100 g (four halves)
Sour Rhubarb Sorbet			1 min	100 g
GARNISH				
Macadamia nuts, chopped				8 g
Macadamia nut oil				5 g
Oxalis leaves				12
Green strawberries, thinly sliced				8 g

**(unattended times)*

ASSEMBLY:

Pacotize or temper churned rhubarb sorbet.

Mix together elements of piquillo pepper and strawberry salad, and season to taste.

Coat halved strawberries with thin dusting of strawberry powder, and sear in grapeseed oil over high heat until charred, about 45 s.

Season with olaroso sherry vinegar and salt.

Arrange one seared strawberry half in bottom of each shallow bowl. Spoon small bed of piquillo pepper and strawberry salad next to strawberry half. Top salad with small spoonful of rhubarb sorbet.

Garnish with macadamia nuts, macadamia nut oil, oxalis leaves, and green strawberries.

Pour chilled gazpacho at table.

STRAWBERRY CONSOMMÉ

Yields 265 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Strawberry juice	250 g (from about 400 g of strawberries)	100%	① Centrifuge juice at 27,500*g* for 1 h.
Fructose	15.5 g	6%	② Season juice, and reserve 65 g.
Malic acid	1.25 g	0.5%	

For more on clarification by centrifuge and other methods, see page 2·364.

Fructose has been shown to enhance the flavor profile of many fruits, including strawberries.

STRAWBERRY GAZPACHO

Yields 850 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Strawberries, sliced	560 g	100%	① Prepare ingredients as noted, blanching onions if needed to remove sulfurous notes.
Cucumber, peeled, seeded, and sliced	140 g	25%	② Vacuum seal together.
Red bell pepper, steamed for 10 min, peeled, and thinly sliced	115 g	20.5%	③ Macerate in refrigerator for 12 h.
Sweet onions, thinly sliced	115 g	20.5%	④ Blend to fine puree.
Extra-virgin olive oil	50 g	9%	⑤ Pass gazpacho through fine sieve.
White balsamic vinegar	20 g	3.5%	
Balsamic vinegar	13 g	2.5%	
Garlic clove, crushed	2 g	0.5%	
Strawberry consommé, from above	65 g	12%	⑥ Add to gazpacho.
Lime juice	15 g	2.7%	⑦ Refrigerate.
White balsamic vinegar	4 g	0.7%	
Malic acid	2 g	0.4%	
Black pepper	to taste		
Salt	to taste		

Preparing gazpacho in advance? Create *à la minute* flavor with this trick from Heston Blumenthal. At the last minute, juice a small amount of the principle ingredient—whether red cabbage, tomatoes, or strawberries—then add it to the existing gazpacho. Enzymes already present in the soup attack components of the added juice and rapidly regenerate some of the aromas lost over time. The fresh flavor comes right back.

Using raspberries, with their bright acidity, makes for an outstanding variation on this gazpacho. Other fruits work, too.

PIQUILLO PEPPER AND STRAWBERRY SALAD

Yields 70 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Strawberries, fine brunoise	35 g	100%	① Measure and reserve individually.
Cucumber, peeled, seeded, and fine brunoise	20 g	57%	
Piquillo pepper, fine brunoise	15 g	43%	
Macadamia nut oil	2.5 g	7%	
White balsamic vinegar	2 g	5.5%	
Garden sorrel, julienne	1 g	3%	
Salt	to taste		

SEARED STRAWBERRY

Yields 100 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Strawberries, halved lengthwise	60 g (two berries)	100%	① Measure and reserve individually.
Freeze-dried strawberry powder see page 3·372	12 g	20%	
Oloroso sherry vinegar	5 g	8.3%	
Grapeseed oil	as needed		
Salt	to taste		

SOUR RHUBARB SORBET

Yields 780 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Rhubarb, thinly sliced	500 g	100%	① Vacuum seal.
Glucose syrup DE40	130 g	26%	② Cook sous vide in 90 °C / 194 °F bath for 2 h.
Sugar	30 g	6%	③ Pass through fine sieve.
Rhubarb juice	200 g (from 350 g of rhubarb)	40%	④ Blend with cooked rhubarb. ⑤ Adjust acidity to taste.
White balsamic vinegar (or other semisweet white vinegar)	9 g	1.8%	⑥ Freeze in Pacojet container. Alternatively, churn in ice cream machine, and store sorbet in freezer.
Malic acid	3 g	0.6%	

For more on juicing methods, see page 2·332.

CRISPY CAULIFLOWER

Marcona almond, Anjou pear, chaat masala, tamarind pudding

In the Levant—Lebanon, Israel, Jordan, and Syria—humble cauliflower is transformed by frying, and then served hot or cold, often with tahini sauce. We intended to do that, too. But when we tasted the *chaat masala* made by Anjana Shanker, one of our chefs, the dish immediately veered toward India. In a good *chaat masala*—one made by a master spice blender like Shanker—no single spice stands out. The resulting flavor is something new, something special.

The secret to making amazing fried cauliflower—with or without *chaat masala*—is to get it a very crispy, nutty brown. Fry up big slabs, and then fry them longer. You will not burn them, because cauliflower doesn't have enough natural sugars to scorch easily. As in tempura, a surprising amount of moisture at the core will quickly wick to the surface after cooking and turn fried cauliflower soggy, so it should be consumed right away.

YIELD:	*four portions*
SPECIAL EQUIPMENT:	*sous vide equipment, deep fryer, whipping siphon*
OPTIONAL EQUIPMENT:	*colloid mill*
TIME REQUIRED:	*3 h overall, including 1 h preparation and 12 min to cook and finish*

ORDER OF PREPARATION:

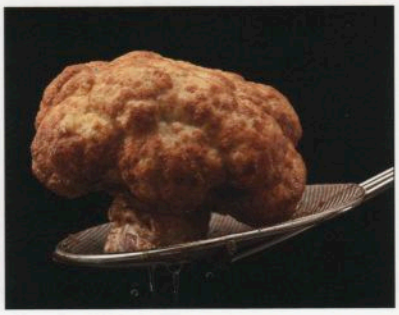
COMPONENT	TIME TO PREP	TIME TO COOK	TIME TO FINISH	QUANTITY
Brown Butter see page 3-213		10 min		40 g
Chaat Masala	20 min	10 min		20 g
Tamarind Puree	5 min	*1 h**		40 g
Marcona Almond Butter Paste	2 min			100 g
Cauliflower Foam	15 min	*1¼ h**	15 min	200 g
Preserved Pear in Mustard Oil	10 min	*2 h**		160 g
Deep-fried Cauliflower	2 min		5 min	450 g
GARNISH				
Curry leaves, julienne				10 g

**(unattended times)*

ASSEMBLY:

Heat frying oil to **195** °C / **385** °F.
Load cauliflower foam into siphon, and warm in **70** °C / **158** °F water bath for 15 min. Charge with two nitrous oxide cartridges.
Deep-fry cauliflower steaks for 5 min, and florets for 3 min, until both are golden brown and crispy. Drain with paper towels. Season with salt and chaat masala.

To finish:
Garnish each warmed plate with Marcona almond butter and tamarind puree.
Place a fried cauliflower steak in the center of each plate.
Scatter pear spheres and fried cauliflower florets evenly among plates.
Finish each plate with cauliflower foam.
Dust plates with more chaat masala, and sprinkle with curry leaves.



Cauliflower doesn't burn readily because it contains low amounts of natural sugars. It's important to fry cauliflower until it is very dry and crispy, typically 5–8 min.

CHAAT MASALA

Yields 70 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Coriander seeds	19 g	76%	① Combine the spices, and roast in 175 °C / 350 °F oven until golden, about 7 min.
Cumin seeds	15 g	60%	
Ajowan	3 g	12%	
Black peppercorns	3 g	12%	
Dried chilies	1 g	4%	
Salt	25 g	100%	② Combine spices with remaining ingredients.
Dried green mango powder (amchoor)	8 g	32%	③ Grind mixture to powder.
Dry pomegranate seeds (anardana)	4 g	16%	④ Pass through fine sieve, and reserve.

TAMARIND PUREE

Yields 240 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Tamarind paste see page 99	140 g	100%	① Vacuum seal together.
Sour Indian plum (alubukhara)	140 g	100%	② Cook sous vide in 90 °C / 194 °F bath for 1 h.
Water	50 g	36%	③ Pass through fine sieve, and measure 225 g.
Coconut sugar (store-bought)	3.5 g	2.5%	④ Blend with tamarind mixture.
Xanthan gum	0.45 g	0.32% *(0.2%)**	⑤ Pass through fine sieve.
Salt	1.5 g	1.1%	⑥ Refrigerate.
Sherry vinegar	1 g	0.7%	

**(% of total weight of cooked tamarind, plum, and water puree)*

MARCONA ALMOND BUTTER PASTE

Yields 350 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Raw Marcona almonds	500 g	143%	① Roast in 175 °C / 350 °F oven until golden, about 15 min.
			② Process roasted nuts with colloid mill or food processor until smooth, and measure 350 g.
Marcona almond butter, from above	350 g	100%	③ Blend together to thicken.
Ultra-Sperse 5 (National Starch brand)	10.5 g	3%	
Salt	to taste		④ Season butter, and reserve.

For more on making nut butters, see page 2·418. Store-bought almond butter also works well here.

CAULIFLOWER FOAM

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Whole milk	375 g	94%	① Simmer together for 20 min.
Cauliflower trimmings	300 g	75%	② Remove from heat, and steep for 45 min.
Water	175 g	44%	③ Strain.
			④ Measure 400 g of cauliflower milk, and reserve.
Cauliflower, thinly sliced	500 g	125%	⑤ Brown cauliflower in butters until very dark and releases nutty aroma.
Brown butter	20 g	5%	
Cocoa butter	15 g	4%	⑥ Puree, and pass through fine sieve.
			⑦ Measure 50 g of puree, and reserve.
Cauliflower milk, from above	400 g	100%	⑧ Disperse gums in cold cauliflower milk.
Low-acyl gellan (Kelcogel F, CP Kelko brand)	1 g	0.25%	⑨ Heat to 95 °C / 203 °F, and hold there for 3 min to hydrate fully.
			⑩ Refrigerate until gel is set, about 5 min.
Locust bean gum (TIC Gums brand)	0.4 g	0.1%	
Browned cauliflower puree, from above	25 g	6.3%	⑪ Puree fully with gelled cauliflower milk.
Salt	to taste		⑫ Season pureed foam base.
			⑬ Refrigerate.

For more on making brown butter, see page 3·213.

PRESERVED PEAR IN MUSTARD OIL

Yields 300 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Anjou pears	250 g	100%	① Peel and core.
			② Scoop 12 spheres with melon baller, and reserve.
Mustard oil	10 g	4%	③ Toast seeds and curry leaves in oil until golden, about 3 min, and reserve.
Yellow mustard seeds	10 g	4%	
Curry leaves	2 g	0.8%	
Water	100 g	40%	④ Combine, and warm to make syrup.
White wine vinegar	75 g	30%	⑤ Add mustard oil mixture.
Glucose syrup DE40	50 g	20%	⑥ Vacuum seal pear spheres with syrup.
Sugar	25 g	10%	⑦ Refrigerate for 2 h before using.

DEEP-FRIED CAULIFLOWER

Yields 450 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Cauliflower, cut into steaks 2 cm / ¾ in thick, small florets reserved	750 g	100%	① Refrigerate until needed.
Chaat masala, from above	20 g	2.7%	② Measure and reserve individually.
Frying oil	as needed		
Salt	to taste		

WATERMELON BULGOGI

Kimchi, ssamjang paste, perilla

Our play on the idea of faux meat takes up *bulgogi*, that addictive smoky, slightly sweet, tangy Korean barbecue. Traditionally, thinly sliced sirloin is marinated overnight in soy sauce, ginger, sugar, sesame oil, and more, then grilled table side. Seattle has a large Korean community, so good *bulgogi* is just around the corner.

But watermelon? It's a nod to one of the most innovative chefs working today, Andoni Luis Aduriz, the chef and owner of one of the world's most celebrated restaurants, Mugaritz, outside San Sebastián, Spain. As far as we know, Aduriz was the first to use compression as a technique in sous vide cooking, creatively modifying textures and flavors. (Read about how this works on page 2·213.) A porous food changes completely. Watermelon flesh, for example, turns a dense, deep red. We dehydrate ours a little, until it is slightly chewy—just like a piece of rare meat.

YIELD: *four portions*
SPECIAL EQUIPMENT: *sous vide equipment, dehydrator*
TIME REQUIRED: *13 h overall, including 2 h preparation and 2 min to cook and finish*

ORDER OF PREPARATION:

	TIME TO			
COMPONENT	PREP	COOK	FINISH	QUANTITY
Watermelon Meat see page 3·394	10 min	*13 h**	20 s	200 g
Watermelon Rind Kimchi	20 min	*12 h**		140 g
Bulgogi Glaze	5 min	5 min		150 g
Ssamjang Paste	5 min			100 g
GARNISH				
Perilla leaves				12
Butter lettuce leaves				12

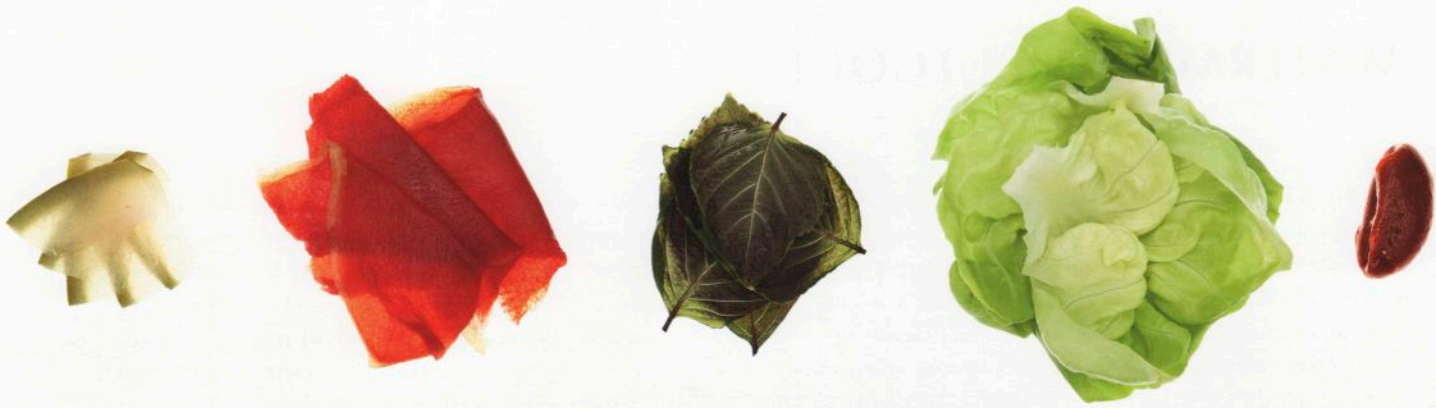
**(unattended times)*

ASSEMBLY:

Sear dehydrated watermelon "meat" in very hot frying pan with a thin layer of oil until golden brown on both sides, about 10 s on each side.

While watermelon meat is cooking:
Warm glaze.

To finish:
Brush glaze over both sides of grilled watermelon slices.
Spoon ssamjang paste on plates.
Arrange watermelon slices on plates.
Finish with watermelon rind kimchi.
Serve with perilla leaves and butter lettuce leaves for wrapping.



WATERMELON RIND KIMCHI

Yields 140 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Water	500 g	250%	① Whisk together until salt and acid have fully dissolved to make pickling brine.
Salt	35 g	17.5%	
Scallions, thinly sliced	30 g	15%	
Sugar	25 g	12.5%	
Ginger, minced	20 g	10%	
Garlic, minced	8 g	4%	
Lactic acid	6 g	3% (*1.2%*)*	
Dried shrimp, minced	5 g	2.5%	
Bird's eye chilies, minced	2 g	1%	
Watermelon rind, peeled and cut into strips 5 cm / 2 in wide	200 g	100%	② Vacuum seal with brine. ③ Refrigerate for 12 h. ④ Drain. ⑤ Refrigerate.

(% of total weight of water*)

BULGOGI GLAZE

Yields 525 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Soy sauce	250 g	100%	① Blend together until sugar has dissolved.
Sugar	105 g	42%	② Refrigerate.
Toasted sesame oil	102 g	41%	
Water	58 g	23%	
Ginger, finely minced	10 g	4%	
Garlic, grated	10 g	4%	

SSAMJANG PASTE

Yields 275 g

INGREDIENT	QUANTITY	SCALING	PROCEDURE
Kochujang (Korean chili paste)	135 g	100%	① Combine to form paste. ② Pass through fine sieve.
Doenjang (Korean soybean paste)	85 g	63%	③ Refrigerate.
Rice wine	27 g	20%	
Toasted sesame oil	19 g	14%	
Garlic, finely minced	14.5 g	10.7%	
Red Fresno chilies, finely minced	10 g	7.4%	

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GLOSSARY OF COOKING TERMS

00 flour—an Italian wheat flour milled from only the core of the wheat grain, yielding a flour with high-quality protein that makes it excellent for forming noodles and certain kinds of bread such as ciabatta.
acetic acid—acid in vinegar, which gives it a sour taste; available commercially.
Activa —(**Activa TG**) the brand name of a transglutaminase enzyme, sold by Ajinomoto, that crosslinks proteins. It is used to bond pieces of meat or seafood together and to strengthen other protein-rich foods, including noodles, doughs, and dairy gels such as yogurt and tofu. Varieties are available that add supplemental ingredients to tailor each product to specific applications; each variety is denoted by two letters after the name, such as **Activa RM**. Activa varieties are sold with different identifiers in different countries: for example, Activa EB is the same product as Activa RM.
Activa EB—see **Activa RM**.
Activa FP—variety of Activa that includes hydrolyzed skim milk protein as an additional protein source for stronger bonds. Hydrolyzed skim milk protein is hypoallergenic and, thus, this version is often used as an alternative to Activa RM (EB) when dairy allergies are a concern. Sprinkle application is not recommended.
Activa GS—variety of Activa designed to create very strong bonds in larger cuts of meats and seafood. Contains sodium chloride, gelatin, trisodium phosphate, maltodextrin, and transglutaminase. Generally recommended for slurry application only, must be mixed with 10–25 °C / 50–77 °F water to dissolve phosphate salt. Caution, slurry has a caustic pH of 11.
Activa PB—see **Activa FP**.
Activa RM—variety of Activa that includes a mix of sodium caseinate, maltodextrin, and transglutaminase that can be applied via sprinkle application, slurry, or directly mixed into various protein-rich foods. The most widely used variety of Activa.
Activa TI or TI-U—kosher variety of Activa. Contains only maltodextrin and transglutaminase. Sprinkle coating and slurry application are not recommended; instead, use by directly mixing into a protein-rich food such as a forcemeat or noodle dough.
Activa WM—see **Activa TI**.
Activa YG—variety of Activa designed for use with dairy products such as yogurt and cheese. Contains maltodextrin, lactose, yeast extract, and transglutaminase.
agar—(**agar agar**) clear, tasteless gelling agent derived from seaweed. Can also be used as a thickener or stabilizer. Available from Asian markets or food ingredient companies. The latter sell agar powder in various grades by gelling strength, which makes for a more reliable product.
agave syrup—(**agave nectar**) sweetener made from agave, a desert shrub-like succulent with sword-shaped leaves. Generally composed of glucose and fructose, but contains smaller quantities of other sugars.
ajowan—(**ajwain**) tiny, seed-like fruits of a variety of lovage with a flavor similar to thyme and caraway. Used in Indian foods.
albumin powder—(**albumen**) dehydrated egg white protein.
Aleppo pepper—medium-hot chili pepper from Syria with a complex, spicy flavor. Most often sold as a coarse ground powder.
almond powder—(**almond flour, almond meal**) almonds ground very finely, with or without the skin.
aloe vera liquid—(**aloe vera juice**) gelatinous pulp from inside the leaves of the succulent aloe plant. Can be used as a thickener and gelling compound.
Alsatian bacon—heavily smoked, cured bacon from Alsace in northeastern France.
alubukhara—(**alu bukhara, aloo bokhara**) sour dried plum or prune available at Indian and Middle Eastern groceries.
amaranth leaves—(**purple spinach, Chinese spinach**) large family of edible greens similar visually and nutritionally to spinach. Some have reddish purple color.
amarena cherry syrup—syrup from a small, dark, slightly sour and bitter variety of Italian cherry that has a distinct almond aroma.
amchoor—(**amchur**) dried green mango powder; used as a seasoning to add a tangy flavor.
amontillado sherry—medium-bodied Spanish sherry, a variety that begins as light fino and is aged in casks, but is bottled before it has made the full transition to a dark oloroso.
amuse-bouche—French term for a bite-size course designed to amuse the palate at the beginning of a meal.
angelica root—used as a flavoring in liqueurs like gin, Chartreuse, and aquavit. Angelica stems are sometimes candied and used as a garnish.
anise hyssop—fresh herb in the mint family with a gentle licorice perfume.
ankimo—Japanese word for monkfish liver.
annatto powder—ground orange-red pulp that covers the seeds of the achiote tree; used primarily as a food coloring; has a slight peppery nuance.
Anti-Griddle—PolyScience tool inspired by Grant Achatz that chills and freezes foods, rather than heating them, on a flat stainless steel surface.
apple pectin—see **HM pectin**.
aquarium salt—commercially available blend of salts that mimic the composition of seawater. Intended to keep sea creatures alive in an aquarium. Not meant to be used as a seasoning.
arame—species of seaweed. The dark brown, firm strands have a mild, naturally sweet flavor. Usually dried.
arborio rice—starchy, short-grain rice; most often used in risotto and rice pudding.
argan oil—very rare and expensive oil made from the kernels of the Moroccan argan tree. Traditionally made from nuts that remain after the fruit has been digested by goats.

aril—botanical term for the juicy pulp surrounding a seed, like the flesh around pomegranate seeds or fresh nutmeg.

arlette—delicate French sweet made from puff pastry dusted with powdered sugar, which is then rolled, thinly sliced, and flattened into paper-thin spirals that are baked until golden brown and crisp.

asafetida—(**asafoetida, hing**) dried yellowish-brown resin from a plant similar to fennel, with a strong, sulfurous aroma that mellows into a garlic, onion flavor when cooked. It is widely used in Indian cooking and is related to the extinct ancient laser plant.

ascorbic acid—scientific name for Vitamin C; used as an acidifier and antioxidant to prevent discoloration in certain plant foods.

Bactoferm—(**Bactoferm F-RM-52**) brand of freeze-dried bacterial culture used to prepare fermented sausages. Made by the Christian Hansen Company.

bagna càuda—warm sauce or "bath" of olive oil, anchovies, garlic, and butter. A specialty of the Piedmont region of northwestern Italy.

bagoong—see **fish sauce**.

banchan—(**panch'an**) Korean term for an assortment of small, often pickled or preserved, side dishes such as kimchi that are traditionally served alongside rice at a meal.

Banyuls—high-end, fortified sweet red wine similar to Port. Made in the Catalan Pyrenees of southwest France.

barbecued eel—(**unagi, kabayaki**) Japanese preparation of freshwater eel cooked over a grill and brushed generously with sweet soy sauce. Available frozen.

Batter Bind S—proprietary blend of modified starch made by National Starch, used to make batters cling better to deep-fried foods.

bay leaf powder—ground bay leaves; best made by freezing with liquid nitrogen and grinding with fresh bay leaves.

béchamel—white sauce. A classic French "mother sauce" of roux-thickened, mildly flavored milk.

beignet—French term for a fritter, fried dough, or batter. Can be sweet or savory.

Beldi olives—(**beldi**) meaty, purple olives from the Moroccan mountains.

belecan—(**belachan**) see **shrimp paste**.

bergamot—variety of yellow- green-skinned orange with a distinctive aroma, used primarily for flavoring Earl Grey Tea.

betel leaf—(**la lop**) heart-shaped leaf of an evergreen creeping vine in the pepper family. A mild stimulant; commonly used by Southeast Asians as the wrapper for paan, spices that are chewed after and between meals.

bincho-tan—(**white charcoal**) Japanese charcoal prepared from oak. Highly regarded for steadily burning at a high temperature and producing very little ash.

biodynamic—complex and almost mystical philosophy of organic farming based on the teachings of Rudolf Steiner (1861–1925).

bird's eye chili—fresh tiny, very hot, red and green chilies. Often used in Thai cooking but similar varieties are used internationally.

bitter orange—(**Seville orange**) variety of tart orange prized for the robust, intense aroma of the zest; often used for making essential oils and orange marmalade.

black cardamom—large, black variety of cardamom with a fibrous pod; interior seeds have a slightly sweet and smoky flavor that is milder than the common green variety.

black gram—(**urad dal**) small oval-shaped beans from India. Often split, skinned, and ground into flour or pastes to make breads such as dosa and idli.

black onion seeds—(**kalonji seeds, nigella**) tiny black seeds from a flowering plant that are roasted and added to curries or sprinkled on bread such as naan. Used in the Bengali five-spice mix, panch phoron.

black radish—variety of winter radish with rough black skin and peppery, white flesh that stores very well. Peel before using.

blanc manger—(**blancmange**) a custard-like sweet made with milk or cream, sugar, and gelatin or cornstarch. Traditionally made with pureed chicken meat or ground almonds and served cold.

blanch—To briefly cook the exterior. To submerge food in boiling liquid briefly to loosen a peel, sanitize its surface, or to remove undesirable tastes or aromas.

blood pudding—(**black pudding, boudin noir**) emulsified sausage made with blood, a cereal or bulking agent such as oatmeal, rice, or chestnut flour, and spices.

Bloom—unit of measurement used to grade gelatin.

bomba rice—Spanish, short-grain, white rice traditionally used for paella.

bonito flakes—(**katsuo bushi**) shavings of cured, smoked, and fully dried bonito, a variety of fish from the mackerel family. A principal ingredient in **dashi**, and also used as a seasoning or garnish.

bottarga—Italian term for salted, pressed, and dried fish roe used as a savory seasoning or side dish. **Bottarga di muggine**, a specialty of Sardinia, is made from gray mullet roe. Among the basic foodstuffs of Mediterranean countries; known as avgotaraho in Greek, batarekh in Arabic, botarga in Spanish, boutargue in French.

boudin noir—see **blood pudding**.

bouquet garni—A classic French mix of pungent herbs that is basic to French cuisine. The herbs include basil, chervil, rosemary, peppercorns, savory, and tarragon. They are tied with string and/or wrapped in a muslin sachet, added to dishes that require long cooking, then removed when cooking is done.

brandade—paste or puree of white fish, most often with salt cod, olive oil, and potatoes. A traditional dish in many regions of the Mediterranean, especially the Basque and Catalan regions of Spain and Provence in southern France.

Brown Ribbon Pectin HV—a high methoxyl **pectin** made by Obipektin. Requires a high concentration of dissolved solids, usually sugar, and a low pH to gel.

brunoise—diced into very small, uniform rhomboid shapes.

bulgogi—Korean term for marinated, barbecued meat, usually beef, cooked over an open flame. Often marinated in soy sauce, sesame oil, garlic, and sometimes sugar.

burdock root—(**gobo**) long narrow root commonly used in Japanese cooking. Should be peeled and soaked in lightly acidulated or salted water before using, to prevent it from

browning and to remove any bitterness.

burrata—fresh, soft Italian cheese made by mixing mozzarella curds and cream wrapped inside a skin of mozzarella.

cake flour—flour milled from a relatively low-protein soft-grain flour. Frequently chlorinated to alter the starch content so that very high sugar and water levels can be used for especially tender and moist cakes (so-called high-ratio cakes).

calcium chloride—mineral salt of calcium, used primarily to trigger gelling for **sodium alginate**, low methoxyl **pectin**, and **gellan** gels. Commonly used for **spherification**.

calcium gluconate—combination of calcium and gluconic acid. Often used as a replacement to calcium chloride because it tastes less bitter. Typically used at three times the concentration of **calcium chloride** for a similar gelling effect.

calcium gluconolactate—(**calcium lactate gluconate**) a calcium salt of lactic and gluconic acids that is often used as an alternative to calcium chloride because it has a slightly less bitter taste. Typically used at 2.2 times the concentration of calcium chloride for a similar gelling effect.

calcium hydroxide—(**slaked lime, pickling lime**) potent alkali salt used to cure lutefisk and olives. Can cause caustic burns if handled incorrectly.

calcium lactate—calcium salt of lactic acid. Often used to trigger gelling with various hydrocolloids, especially dairy-based gels, because it tastes less bitter than **calcium chloride**. Used at 1.5 times the concentration of calcium chloride for a similar gelling effect.

calcium sulfate—(**gypsum**) a commonly occurring calcium salt that is traditionally used as a coagulant when making tofu. Can be used as a calcium source for gelling other **hydrocolloids**. Used at 1.2 times the concentration of calcium chloride to provide approximately the same concentration of calcium ions to trigger gelling.

candlenuts—(**kukui nuts**) slightly bitter tropical nut with a very high oil content traditionally used as an ingredient in Hawaiian poke and to enrich Southeast Asian curries. They must be cooked before they are consumed, or they can cause stomach distress from mild toxins.

caper berries—fruit of a caper bush. Most often sold pickled with the stems intact.

carbon black powder—natural, spray-dried, food-grade black coloring.

carpaccio—traditional Italian dish of raw meat sliced or pounded very thin. Recently it has been used as a term to describe any food that is presented raw and paper-thin.

carrageenan, iota—vegetarian and vegan gelling alternative to gelatin, extracted from a variety of red seaweed sometimes called Irish moss. Iota type makes soft, elastic gels. Also works as a stabilizer and thickener when used at very low concentrations.

carrageenan, kappa—vegetarian and vegan gelling alternative to gelatin, extracted from a variety of red seaweed sometimes called Irish moss. Kappa type makes firm, brittle gels. Best with dairy products.

carrageenan, lambda—stabilizer and thickener extracted from a variety of red seaweed sometimes called Irish moss. Lambda type does not gel.

cassava root—(**yuca, manioc**) starchy, tuberous, tropical root considered a food staple in many regions. The source of tapioca. Varieties of bitter cassava contain cyanide and related compounds and must never be eaten raw.

cavitation—the formation of void- or vapor-filled bubbles in a liquid via a fast-moving solid object, such as a propeller, or via sound waves. The collapse of the bubbles creates strong shock waves.

cellulose acetate sheet—food-grade transparency sheet, used as a casting surface for smooth, glossy results.

cellulosic gums—family of **hydrocolloids** derived from plant fiber, includes methylcellulose, hydroxypropyl methylcellulose, and carboxyl methylcellulose.

cha plu leaf—see **betel leaf**.

chaat masala—combination of spices used as a sprinkle on everyday foods and fruits in India. Blends vary by region and producer.

chaat—term used in India to refer to snacks, which are often savory dishes sold by street vendors.

Champion juicer—brand of juicer that uses a rapidly turning spindle with serrated teeth, rather than centrifugal force, to grind and compress food. The process releases liquid and then separates it from solids by pressing the food through a sieving plate.

chanterelles—(**girole**) wild, funnel-shaped mushrooms, valued for their golden color and nutty, buttery flavor. Black, white, and grey varieties are less common.

chawanmushi—(**chawan mushi**) Japanese term for savory egg custard steamed in a bowl or cup, often made with seafood.

chervil—tender, parsley-like herb with a faint licorice taste; a traditional ingredient in the French fines herbes mix.

chickpea flour—(**besan, gram flour**) gluten-free flour milled from dried chickpeas.

chickpeas—(**garbanzo, ceci, Bengal gram**) high-protein legume. Available dried or canned but rarely fresh.

Chinkiang vinegar—(**Zhenjiang**) Chinese black vinegar with complex flavor from fermentation; commonly used in sauces, marinades, and braised dishes.

chinois—a cone-shaped sieve with a handle; usually made from fine steel mesh.

choucroute—French word for sauerkraut. Choucroute garnie is classic Alsatian winter meal of sauerkraut with sausages and other pork products, charcuterie, potatoes, goose fat, dry white wine, and spices. Choucroute royale is a grander version commonly made with foie gras, wild game, and Champagne.

chufa—(**tiger nut**) dried tuber of a type of tropical sedge, among the oldest cultivated plants. Used for making Spanish horchata.

cilantro 'Delfino'—a feathery, intensely green cilantro with a spicy flavor.

cinnamon basil—aromatic variety of basil that contains the compound cinnamate.

cipolline—small, flat, onion-like bulbs of the grape hyacinth, originally from Verona, Italy. Often served as a vegetable in sweet and sour preparations.

cockscomb—fleshy, red display skin on a rooster's head.

coconut cream—thick creamy liquid made by grinding fresh coconut meat in water, then skimming the fatty "milk" from the top.

coconut sugar—granulated sweetener made from the condensed, crystallized nectar of the coconut palm blossom.

coconut water—the liquid inside young, fresh coconuts. Not to be confused with coconut milk.

cold-smoke—to flavor and assist in preserving food with smoke at moderate temperatures, generally below 30 °C / 86 °F, for up to a month.

colloid mill—heavy-duty grinding machine used to reduce foods (especially durable foods like nuts) into very small particles. Also used to prepare emulsions.

Comté—French, aged cow's milk cheese with a nutty flavor similar to Gruyère.

Condrieu—French white, northern Rhône wine usually made from Viognier grapes.

confit—a French term that literally means "preserved." Meat confit has historically meant a preparation of salt-cured meat cooked and kept in fat to provide an airtight seal that helps preserve the food. For fruits, confit or confiture means preserves—as in jams and jellies. Confit has come to mean almost any food cooked slowly in oil or fat until tender.

consommé—thin, flavorful, and very clear liquid. Traditionally made from meat broths; today, often prepared from vegetable and fruit juices as well.

Controne hot pepper—an Italian variety of hot, dried chili, often sold coarsely ground.

cooking to core—(**cooked to core**) phrase used to describe the technique of cooking an ingredient to a specific core temperature that is identical to the temperature of the surrounding environment. The more traditional method is cooking "hotter than core" in an environment hotter than the desired final core temperature of the cooked food.

core temperature—temperature at the very center of the food. Usually established by a probe thermometer.

cornichons—tiny, tart, and crunchy pickled gherkins or small cucumbers.

crab liver—creamy yellow or yellow-green paste (the hepatopancreas) from fresh crab; eaten alone or added to enrich sauces.

cream of tartar—a potassium salt derived from tartaric acid, usually as a by-product of wine making.

creamed honey—honey that has been whipped until it is opaque and spreadable.

crème fraîche—French term for thick and tangy cream; traditionally prepared by wild fermentation, but now prepared with a commercial culture.

Crisp Coat UC—proprietary blend of modified starch from National Starch. Used to prepare batters that produce fried foods with a delicate, crisp crust.

cromesquis—fried, crispy foie gras fritters, popularized by French chef Marc Meneau.

croquant—French term for crisp. Also, crunchy sugar glass made from fondant.

croquetta—typical Spanish tapa of battered, fried béchamel flavored with chicken, fish, or vegetables.

crosnes—(**Chinese artichoke**) small, crunchy, caterpillar-shaped, tuber with sweet, nutty flavor similar to artichokes.

crown—cut of poultry that includes the breasts, rib cage, and wings.

cryomeringue—flavorful foam of egg white frozen in liquid nitrogen, often until crispy on the outside and soft on the inside.

cryopoach—to bathe in liquid nitrogen.

cryorender—technique that involves alternating cooking at a very high temperature with either a resting step on dry ice or a quick dip in liquid nitrogen to freeze the flesh just beneath a fatty surface layer.

cryosear—technique of flash freezing food with dry ice or liquid nitrogen before exposing it to high-temperature searing or deep-frying.

cubeb—(**Java pepper, tailed pepper**) wrinkled, hard, round spice with the look and taste of black pepper and a hint of allspice.

cure—to preserve food with salt. Often combined with smoking. Confusingly, a curing brine is sometimes called a "pickle," and sometimes foods pickled in an acidic solution are referred to as cured, although the underlying processes are different.

curry leaves—small, green, complexly flavored herb widely used in India as a seasoning or fried crisp as a garnish.

daikon radish—giant white radish, crisp and slightly sweet.

dashi—(**hon dashi**) clear Japanese broth made with **kombu** and dried bonito flakes; a primary building block of Japanese cooking. The first extraction is called **ichiban dashi**, the second is **niban dashi**.

decant—to pour a liquid from one vessel to another, often for the purpose of separating liquid from sediment.

deckle—name for the muscle cap on loin cuts, particularly a rib eye steak.

deeply chill—to hold food, usually meat or seafood, a degree or two below the freezing point of pure water so that some, but not all of the water in it is frozen. Also, to cool a liquid to just above the freezing point of pure water, which causes certain types of gels to set rapidly.

deglaze—to add liquid to a pan to dissolve the flavorful brown film and bits formed from dehydrated juices when many foods are cooked at a high temperature.

deodorized cocoa butter—pure cocoa butter with the natural aroma removed, usually by distillation. Use only food grade.

deoiled soy lecithin powder—see **soy lecithin powder**.

desalt—to soak in water to remove salt so that very salty cured foods like salt cod are palatable in certain preparations.

Dewar bowl—insulated bowl used to hold liquid nitrogen when dipping or poaching.

Dewar flask—vacuum-insulated vessel designed for storing and dispensing liquid nitrogen or other cryogens.

dextrose equivalent or DE—scale indicating the effective level of glucose in various products, including confectioner's syrups and maltodextrins: 100 equals pure glucose (or dextrose), 1 equals pure starch.

dextrose—also known as glucose, but not to be confused with glucose syrup, which is not 100% glucose sugar. Perhaps the most common sugar in nature, dextrose has a sweetness approximately half that of sucrose (table sugar). It is commonly added to fermented food preparations, such as sausages, to fuel fermentation bacteria.

diglycerides—a family of emulsifiers that are incomplete fat molecules with only two fatty acid "tails" attached to a glycerol "backbone."

disperse—to evenly distribute, an important step when working with **hydrocolloids**.

distillate—vaporized and then condensed and collected essences that are, typically, the desired product of distillation.

dosa—South Indian pancake made from a lightly fermented batter of beans (urad dal) and rice.

dried scallop—(**conpoy**) cooked, salted, dried, and aged scallops. A costly traditional food in China used as a flavorful and salty seasoning. A key ingredient in XO sauce.

dry blend—evenly combine dry ingredients before adding them to a recipe, an important step when combining various hydrocolloids for thickening or gelling.

dry-bulb temperature—a temperature measurement of air. Unlike the **wet-bulb temperature**, humidity in the atmosphere is not a factor in the measurement.

dulse—(**dilsk**) red algae or seaweed used in a variety of cooking applications and served as a snack food. Can be used fresh or dried.

edamame—green soybeans, often sold in the pod.

egg yolk powder—dehydrated egg yolk powdered by spraying or grinding. Often used as an emulsifier, it can also be used to add concentrated egg flavor without water.

elderflowers—(**elder blossoms**) small, aromatic flowers from an herbaceous shrub, often used to flavor a sugar syrup.

elephant garlic—plant in the leek family that forms large, mild, garlic-flavored bulbs.

enocianin—pigment that imbues a red to purple color to the skin of red grapes. Also sold commercially as a powder used to impart their purplish-red color to beverages.

enoki—(**enokitaki**) tiny, long-stemmed mushrooms with a mild flavor. Cultivated enoki are usually white; wild are often brown.

enzyme clarification—method of clarifying liquids by adding a commercially prepared enzyme such as Novozymes brand Pectinex Smash XXL. Causes suspended solids to aggregate and precipitate out of a liquid. The technique is widely used to aid the pressing stage or clarification process for juices, wine, or beer.

enzyme peeled—the removal of the covering membrane of citrus segments by soaking in a solution that includes **pectinase**. Novozymes brand **Pectinex** is a common brand that is designed for this purpose.

escabeche—spicy, tart Spanish sauce usually made with vinegar, garlic, and onions. Traditionally a technique of lightly pickling cooked foods like fried fish to prevent them from spoiling.

escolar—(**white tuna, butterfish**) rich fish that is sometimes eaten raw as sashimi. Eating more than 150 g can cause stomach distress in some people due to naturally occurring gempylotoxin (wax esters) that cannot be digested.

Espelette pepper—small, dried, medium-hot chili from the Basque region of southwest France. Commonly sold as a coarsely ground powder.

essential oil—concentration of volatile aromatic compounds from spices, herbs, flowers, and other botanicals. Used widely in perfumery, but many are food grade.

farce—French term for stuffing or forcemeat.

fenugreek leaves—fresh greens from a plant in the pea family. Fenugreek seeds are used as a spice. The taste is bitter when raw but becomes sweeter when cooked.

fermented black bean and chili paste—commercially available.

Fermento—a commercial culture of prefermented skim milk powder and whey protein. It is added to forcemeat preparations to eliminate the traditional fermentation step by directly lowering the pH of the mixture.

fiddlehead ferns—tender, edible, coiled sprouts of the fiddlehead fern. Collected in early spring.

fines herbes—A traditional French mix of herbs, including fresh parsley, chervil, chives and tarragon, that is ubiquitous in French cuisine. Marjoram, cress, and lemon balm may be added.

fingerling potatoes—varieties of waxy, thin-skinned, slightly sweet potatoes that grow in long, narrow oblongs resembling fingers. Ideal for potato puree preparations.

fish sauce—(**garum, nam pla, nuoc mam, muria**) clear, salty condiment or seasoning made from salted, fermented fish. Used widely in Southeast Asian cuisine.

flaky salt—salt crystals that grow as broad, flat flakes. Maldon brand sea salt is a well-known example.

flash—to expose food to extreme hot or cold temperatures, such as flash freezing with liquid nitrogen or flash frying with hot oil or in a hot pan.

flattened rice flakes—(**poha, beaten rice**) quick-cooking white rice from India that has been flattened. Used to make puffed rice or fermented batters like dosa.

fleur de sel—French, fine-grain sea salt that is harvested by hand from tidal pools.

fluid gel—any gel that is set and can then be sheared to a highly **thixotropic** (shear-thinning), fluid consistency, or a gel that is stirred as it sets so that it remains fluid. Often used as an alternative to traditional thickeners because of their clean mouthfeel and excellent flavor release property.

fluke—(**flounder**) various kinds of flat fish.

FMC BioPolymer Viscarin TP 389—a brand and grade of sodium alginate.

foie gras fat—fat that is collected after cooking foie gras.

fondant—French word for melting; used to describe a food that is meltingly tender. Also, a pliable paste made from carefully recrystallizing sugar syrup so that it has microscopically fine sucrose crystals.

fond—French term for a dish's base or foundation, such as a stock or broth.

forbidden rice—especially nutritious strain of Chinese black rice once reserved for royalty. Consists of small smooth grains that, when cooked, do not have the glutinous quality of many Asian rice varieties.

forcemeat—finely ground mixture of salted and seasoned meat or seafood.

freeze-concentrate—to concentrate by slowly freezing water and then decanting, straining, or centrifuging the flavorful liquid from ice crystals.

frenched—butcher's technique of cleaning

and scraping away meat to expose the bone for a more elegant presentation. Lamb chops are commonly frenched.

fresh turmeric—fresh rhizome of the turmeric plant.

fresh wasabi—fresh green root sometimes called Japanese horseradish. Freshly grated wasabi is much more delicate and floral than dried or commercially prepared wasabi paste.

fricassee—(**fricassée**) a white meat preparation, traditionally chicken, that is stewed in a white gravy. Various vegetables are often incorporated and the gravy sometimes includes white wine.

frisée—(**curly endive**) a wiry, ruffled, slightly bitter green in the endive family that is used in salads or lightly braised.

fructose—sugar that is about 1.5 times as sweet as sucrose (table sugar) that is found in many fruits and honey. Granulated fructose is commercially available.

fumet—fish stock or the cooking liquid collected from fish or shellfish preparations.

furikake—Japanese seasoning mix often used as a seasoning for rice. Usually contains seaweed flakes, dried fish, and sesame seeds.

galangal—variety of ginger rhizome (root). It tastes like ginger with a little more pepper and light camphor aroma. Often used in Thai cooking.

gapi—see **shrimp paste**.

garam masala—Indian spice mix that traditionally includes pepper, cumin, cinnamon, cloves, and cardamom, but there are many variations. Often ground finely and added at the end of cooking.

garlic scapes—immature flower stalk of the garlic plant. Can be sautéed and served as a green vegetable.

garum—ancient Roman fish sauce made by fermenting and drying the salted innards of mackerel or similar fish. Substitute **nam pla**.

gastrique—sweet and sour sauce, often made with a caramelized sugar dissolved in vinegar and sometimes fruit juice. The mixture is reduced to taste. Fruit is often added to the caramelized sugar as well; it is cooked to a pulp during the reduction.

gellan—see **low-acyl gellan** or **high-acyl gellan**.

gentian flowers—wild yellow or blue flowers, a key ingredient in several liquors.

gentian root—key ingredient in Angostura bitters.

geoduck—(**king clam**) a huge bivalve mollusk with a very long siphon, native to the northwest coast of North America.

ghee—slowly clarified butter used prominently in North Indian cooking.

Glice—emulsifier made by Texturas. A proprietary blend of monoglyceride and diglyceride emulsifiers.

glucono delta lactone—(**GDL**) an acidic compound produced by the fermentation of glucose. Used as an acidifier, in fermentation, as a coagulant in tofus, as a sequestrant, and occasionally as a component in baking powders. It is valued for its slow acidifying effect, which can occur over minutes or hours depending on conditions.

glucose syrup—a syrup prepared by degrading starch into glucose sugar. The conversion is never complete, and all syrups are given a DE number (typically between 36 and 47) that indicates how completely starch has been converted into glucose.

glucose—see **dextrose**.

glycerin flakes—a generic name used (incorrectly) for a blend of monoglyceride and diglyceride emulsifiers.

glycerol monooleate—powerful purified monoglyceride, an emulsifier.

glycerol monostearate—purified monoglyceride used as an emulsifier.

glycerol—(**glycerin**) a slightly sweet-tasting liquid, edible humectant used to maintain moistness in many baked goods, also useful in foods like gels and edible films.

gnocchi—Italian term for dumpling. Typically made with potato or semolina.

golden oregano—variety of oregano with yellow leaves and a delicate, peppery flavor.

grains of paradise—ancient spice with a peppery bite, commonly used in North African and West African cooking.

granita—flavored ice similar to sorbet but with large ice crystals that form as a result of low sugar and dissolved solids content.

green almonds—developing fruit of the almond, picked when still green, moist, and fleshy outside and the inner shell has not yet hardened. The flavor is slightly sour. Also, almonds that have not been dried or aged.

green garlic—see **Spring garlic**.

green hazelnuts—(**cobnuts**) young hazelnuts that still have their tender, green husk. Cracked and eaten fresh or added to recipes for a nutty, legume-like flavor.

green mango—tart, firm mango picked before it has ripened. Can be pickled or added fresh to South Asian dishes; dried, it makes the Indian seasoning amchoor.

green walnuts—(**wet walnuts**) fresh walnuts that have not been dried for storage.

gremolata—Italian condiment of chopped parsley, garlic, and citrus zest. Traditional accompaniment for osso buco, Italian braised veal shanks.

groats—hulled, crushed grains, such as barley, buckwheat, or oats.

guar gum—thickener from the endosperm of guar seeds. Similar to locust bean gum.

gum arabic—(**gum acacia, chaar gund**) water-soluble gum from the hardened sap of acacia trees. Contains a complex mix of polysaccharides and glycoproteins, it is used as a stabilizer in the manufacture of food products, particularly confections. Often used as a glaze that can be dried to a hard, shiny coating.

gunpowder tea—aromatic green tea made from individual leaves that have been rolled into pellets.

halvah—(**halva**) popular Middle Eastern confection made from ground sesame seeds and honey; sometimes with almonds, pistachios, nut butters, and sugar added.

hamachi—(**yellowtail, Japanese amberjack**) a variety of round fish very popular as sushi or sashimi.

hard cider—apple cider that has been fermented and contains alcohol. Fermented cider is also made into vinegar and brandy, such as Calvados in France.

hazelnut flour—finely ground, dried hazelnuts, often pressed to remove the oil before milling.

hermetically sealed—water and airtight.

high-acyl gellan—(**Kelcogel LT100**) a hydrocolloid that makes opaque, soft, elastic

gels at low concentrations. Particularly useful in dairy gels.

hijiki—dried, brown seaweed that resembles twigs when dried and noodles when reconstituted. Used in soups and salads.

HM pectin—see **pectin**.

hoisin sauce—(Peking sauce) sweet, spicy reddish-brown Chinese sauce made from soybeans, garlic, chili peppers, and spices.

hops—bitter, conical flower of the hop vine used primarily in beer brewing.

horchata—sweet beverage originally made from chufa nuts, but now often made with rice or almonds.

hot smoke—the process of smoking food at temperatures typically above 60 °C / 140 °F, resulting in a fully cooked product.

hydrate—made to fully absorb water, an important step when using hydrocolloids that renders them functional. To be fully hydrated, most must be heated above a certain temperature that depends on the specific hydrocolloid and nature of the liquid it is dispersed in.

hydrocolloid—any substance that thickens or gels water, or a liquid containing a significant fraction of water.

hygroscopic—any material that strongly binds water molecules; will readily absorb moisture from the atmosphere.

ice plant—(**ficoïde glaciale, ice lettuce**) a succulent heirloom green from France that appears to be covered in frozen droplets of water; it has a mildly salty taste and can be used to add texture to salads.

Idiazabál—firm, aged sheep's milk cheese from the Basque country of Spain with a nutty, buttery flavor.

immersion blender—(**stick blender**) a handheld electric device that chops, blends, and purées food in the container where they are being prepared.

Indian eggplants—small, round purple eggplants similar in size and shape to an egg.

Insta Cure No. 1—curing salt blend of 93.75% salt, 6.25% sodium nitrite, and safety coloring.

Insta Cure No. 2—curing salt blend of 92.75% salt, 6.25% sodium nitrite, 1% sodium nitrate, and safety coloring.

isomalt—sugar substitute composed of one molecule each of glucose and mannitol that is about half as sweet as sugar. Suitable for diabetics. Often used in confectionery work because it does not color at high temperature and is not very hygroscopic, which means it doesn't get sticky in a humid environment.

jamón Ibérico—(**pata negra**) a cured Spanish ham from black-footed Iberian pigs. Considered a superior ham for its complex, nutty, and slightly sweet flavor. **Jamón Ibérico de Bellota** is a luxury ham made from Iberian pigs that feed on wild acorns.

Japanese cucumber—(**suhyo**) long, narrow cucumbers with thin, spiny skin and tender, crisp flesh.

Japanese puffed rice—snack food that resembles slightly larger version of a puffed-rice American breakfast cereal.

julienne—to cut into thin sticks.

kabocha squash—(**kabocha, Japanese pumpkin**) round, sweet winter squash with green skin and bright orange interior.

kalbi—(**galbi**) Korean word for "rib." Usually refers to sliced short ribs. Also describes a soy sauce marinade used in Korean barbecue.

kalonji seeds—see **black onion seeds**.

kampachi—(**kanpachi, almaco jack**) young yellowtail, often served as sushi or sashimi. Popular large fish, frequently farmed, with 30% fat content; high in omega-3 fatty acids.

kaolin clay powder—edible clay. Sometimes used as a thickening ingredient.

kapi—see **shrimp paste**.

kecap mani—thick, sweet, Indonesian soy sauce used as an ingredient or condiment.

Kewpie mayonnaise—popular brand of Japanese mayonnaise made with rice vinegar that includes a small amount of monosodium glutamate for an enhanced umami taste.

king trumpet mushroom—(**royal trumpet, king oyster**) largest species of oyster mushroom with a firm texture.

kinome—young leaves of the prickly ash or sansho plant, best in the spring when the leaves are tender, with a citrus-like, bright pepper bite. Dried, ground leaves are also called **sansho**.

kochujang—(**gochujang**) Korean chili paste.

koenjang—(**doenjang, dhwen-jang**) Korean fermented soybean paste.

Koji-Aji—a powdered flavor enhancer and MSG substitute made by Ajinomoto. Made with fermented wheat protein, yeast extract, and maltodextrin (as a bulking ingredient).

kombu—Japanese term for dried kelp, an important ingredient in the flavor and seasoning of Japanese food. Many varieties and grades are commercially available.

Kombu powder is ground dried kelp.

konjac gum—(**konjac flour**) a hydrocolloid thickener made from the dried, swollen stem (corm) of the konjac plant, native to tropical Asia. Konjac flour has 10 times the thickening strength of natural cornstarch.

kudzu—(**kuzu**) starch used for thickening; made from the root of a climbing vine.

kukui nut—see **candlenuts**.

Kumamoto oyster—very popular, small Pacific oyster with a cupped shell; cultivated from Canada to Mexico.

kuri chestnut—large, sweet, Japanese chestnut.

Kusshi oysters—small, deep-shelled Pacific oyster from British Columbia with a characteristic sweet flavor.

lactic acid—the acid found in sour milk, yogurt, cheese, and many other dairy foods. Can be used to give a preparation a dairy-like tartness. Also can be used as a coagulant for protein gels.

laminate—to separate into thin layers, or to compress those layers into one, strong sheet. In cooking, a technique of layering pastries, dough, or other material to build distinct constructions.

langoustine—small, Mediterranean spiny lobster, an ingredient in many traditional European seafood preparations.

laver—smooth, broad leaves of tender algae used to make nori sheets. Eaten fresh in Europe. Flavor evokes olives and oysters.

L-Cysteine—amino acid, often added at very low concentrations to dough to weaken gluten. Commonly used commercially to

give hamburger bun dough a soft, flowing consistency that aids in shaping the buns. It also ensures the buns don't rise too high during proofing and baking.

lecithin—the principal emulsifier in egg yolks, also found in soybeans. Most commercially available lecithin products are derived from soy.

LM pectin—see **pectin**.

lobster mushroom—large reddish-orange fungus with a firm, dense texture. Not a true mushroom but a fungus that colonizes and alters a mushroom host, thus they must come from a trusted source.

locust bean gum—(**LBG, carob bean gum**) hydrocolloid thickener extracted from the pods of the carob tree. A small amount of protein impurity in the gum gives it emulsification properties as well.

lovage leaves—green, leafy plant similar to celery; long used in southern Europe as an herb or a green, often in savory pies.

low-acyl gellan—(**Kelcogel F**) **hydrocolloid** that makes clear, firm, brittle gels at low concentrations. Requires specific concentrations of ions, usually calcium, to gel.

lutefisk—lye-cured fish (cod, ling, or other whitefish); eaten in Norway, Sweden (lutfisk), and parts of Finland and in the American Midwest.

mace blade—a frond of the dried formations that cling to the nutmeg seed.

macerate—to steep food in liquid to allow flavors to infuse in or seep out.

Maillard reaction—a complex set of reactions among amino acids and sugars that creates the deep brown color and many of the essential aromas and flavors of baked, roasted, and fried foods. In cooking, the Maillard reaction usually occurs well above the boiling point of water and is therefore associated with cooking methods that use high heat. Browning due to the Maillard reaction is often confused with caramelizing sugar, which is unrelated.

maitake—(**hen of the woods**) wild mushroom prized for an excellent savory flavor.

makrud lime leaves—(**kaffir lime leaves**) aromatic leaves of a thorny bush. Often used in Thai cookery.

malic acid—acid derived from apples and many other fruits.

malt syrup—sweet syrup, mostly comprised of maltose, derived from malted grains.

maltodextrin—(**dextrin**) a carbohydrate from partly degraded starch. Frequently used as bulking agents, maltodextrins are available at different **DE** values (typically between 4 and 22), with lower-numbered grades behaving more like starches and higher-numbered grades acting more like glucose syrup when dissolved.

Maltrin M100—proprietary blend of maltodextrin and corn syrup solids.

malt—sprouted and kiln-dried grains. A sugar syrup, predominantly maltose, is derived from malted grains.

mandolin—metal or plastic manual slicer on a thin plane with an adjustable blade.

Manglitsa pork—meat from a breed of pig originating in Hungary that has woolly hair and highly marbled meat.

mannitol—mildly sweet sugar alcohol. Sold as a crystalline powder and used as a sweetener or as a source of dissolved solids for stabilizing preparations. In its crystalline form, it has a slight mouth-cooling effect as a result of the relatively large amount of heat needed to melt and dissolve the crystals.

manzanilla sherry—pale, dry sherry from Andalusia in Spain. Added to savory sauces or served cold.

MAPP gas—preferred gas for kitchen torches; burns very clean and hot.

Marcona almond—short, round, slightly sweet almond from Spain that is often sold fried in oil and salted.

marmalade—a citrus jelly with visible pieces of suspended fruit and rind.

marmelade—French marmalade. Usually thick, slow-cooked fruit puree, traditionally with no recognizable fruit pieces.

marrons glacés—French term for candied chestnuts.

Mason jar—well-known American brand of resealable glass canning jar.

matcha—Japanese green tea powder made from very high-grade tea.

mesophilic culture—organisms used to create distinct, cultured flavors in cheese and yogurt. They thrive at 25–40 °C/ 77–104 °F. Blends of various strains are available as commercial fermentation starter cultures.

methylcellulose—group of hydrocolloids derived from cellulose in plants that gel when heated and melt when cooled. **Methocel** is the brand name for Dow Chemical Company's brand of cellulosic gums, which includes methylcellulose formulations.

Meyer lemon—citrus cultivar thought to be a cross between a lemon and a mandarin orange. It has a thin yellow skin with a pungent citrus aroma, a slightly sweet taste, and mild acidity.

miang—(**miang kham**) Thai snack food of savory tidbits wrapped in a cha plu or piper betel leaf.

microcrystalline cellulose—thickener derived from plant cellulose. Not a gelling compound. Not to be confused or interchanged with methylcellulose or other cellulosic gums.

Microplane—brand of kitchen rasp, used for fine grating or shaving.

mi-cuit—French term for "partially cooked." Describes foie gras served pink in the center and fish warmed through but not flaky.

mignonette—cold sauce with plenty of pepper, red wine vinegar, chopped shallots, and salt; traditionally served on oysters.

mirin—sweet, Japanese rice wine similar to sake but with a lower alcohol content.

miso—Japanese fermented soybean paste used for seasoning. Comes in many varieties. **Shiro miso** is pale and mild, **aka miso** is a more mature red miso with a more pronounced flavor and salty taste.

mochi—Japanese paste made of sweet, glutinous rice.

monoglycerides—a family of surfactant emulsifiers with a single fatty acid "tail" linked to a glycerol "backbone" molecule.

mother sauces—The four basic building-block sauces of French cuisine: béchamel, espagnole, velouté, and allemande. First classified in the 19th century by renowned French chef Antonin Carême.

Moulard duck—(**Mulard, mule duck**) a hybrid duck that is widely grown for foie gras and meat.

muria—ancient Roman fish sauce made from tuna innards; considered second-quality compared to **garum**.

muscovado sugar—unrefined brown sugar with a strong molasses flavor.

mushroom gills—dark, papery ribs that hold the spores; on the underside of mushroom caps; used to color sauces.

mushroom soy sauce—Chinese soy sauce flavored with straw mushrooms.

Mutsu apple—(**Crispin**) yellow Japanese apple.

myoga—(**ginger bud**) edible flower bud from several varieties of ginger, often shredded and used as a garnish for fish.

myoglobin—oxygen-carrying protein in muscle fibers, related to hemoglobin. Its color varies from bright red to dark purple depending on oxygenation. Certain conditions degrade the protein, giving it an unappealing brown color.

nage—thin broth with bits of vegetables or seafood that "swim" when the soup is stirred.

nam pla—see **fish sauce**.

negi—(**Welsh onion, Japanese leek**) slender, mild variety of leek.

neutral oil—any variety of cooking oil that adds no strong or specific flavor of its own.

nori—sheets of edible seaweed (laver) commonly used to make sushi rolls. **Nori flakes** and **nori powder** are variations.

nougatine—hard, thin sheets of caramelized sugar laced with nuts. Savory versions can be made with less-sweet sugars.

nuka—rice bran used to make **nukazuke**, a type of Japanese pickles.

N-Zorbit M—modified starch derived from tapioca; made by National Starch. Unique in its ability to transform oils into powders that melt back into oils when wetted.

offal—organ meats.

ogo—crunchy fresh seaweed with delicate, lacy branches. A traditional ingredient in Hawaiian poke.

oiled lecithin—used as an emulsifier and foaming agent.

oleic acid—type of fat commonly found in many animal and plant foods.

oloroso sherry vinegar—vinegar made from dark, nutty, Spanish sherry.

omakase—Japanese term for a menu selected for the guest by the chef. Often described (somewhat erroneously) as the Japanese equivalent to the Western idea of a tasting menu.

orange blossom water—(**orange flower water**) the hydrosol from the distillation of bitter orange blossoms, often flavors Middle Eastern, Turkish, and Greek cakes and pastry.

osmanthus vinegar—a semisweet vinegar made with Chinese osmanthus blossoms. Has the aroma of fresh apricots.

pacotize—to use a Pacojet to puree food.

pain d'épices—French spice bread.

palm sugar—(**jaggery**) unrefined, coarse sugar made from palm sap or sugar cane juice.

pancetta—cured, unsmoked Italian bacon, often prepared by rolling pork belly into a cylinder.

pandan leaves—(**pandanus**) aromatic leaves with a sweet, characteristic flavor; pounded, ground, or used as a wrapper in Malaysian and Indonesian sweets, drinks, and savory dishes.

panko—shredded or flaked white bread crumbs from Japan used for breading.

papadam—Indian cracker made from lentil paste. Dried wafers cook into crisp, slightly puffed snacks.

paratha—pan-fried crisp, layered flatbread from India.

parisienne—cut into small round balls with a melon baller or, in French, a *cuillère parisienne*.

pastis—high-alcohol, anise-flavored aperitif popular in the south of France.

pastry comb—large tool with teeth; used to create even ridges and lines in pastry work.

pâte de brik—thin North African pastry similar to phyllo. Forms the shell for sweet and savory pies (brik), such as Tunisian tuna-egg turnovers and Moroccan bisteeya.

pavé—shaped like a brick or block.

pea vines—young tender shoots of edible pea plants. Used fresh or stir-fried.

pectin HM—(**high-methoxyl pectin**) derived from fruit, usually lemon peel or apple pumice, that will gel a liquid, but only at appropriately low pHs (acidic) and with high concentrations of dissolved solids such as sugar present. Forms firm, elastic gels with a good flavor-release quality.

pectin LM—(**low-methoxyl pectin, apple pectin**) modified pectin that will gel at much higher pHs (less acidic) and with very low levels of dissolved solids. Requires calcium or another suitable ion to trigger gelling. Forms tender to firm, slightly brittle gels with a very good flavor-release quality.

pectinase—enzyme from *Aspergillus aculeatus,* an enzyme that softens plant tissues. Used for enzymatic peeling.

Pectinex Smash XXL—brand name of a Novozyme product used as an aid for pressing and for clarification in the juice, wine, and brewing industries.

pectin—principal molecules that compose and bind cell walls together in plants. When dissolved, it will form a gel under the right conditions; widely used for thickening and gelling fruit jams and jellies.

Pen shell clam—(**pinnidae**) very large, triangular clam with an edible abductor muscle that is similar in appearance to a scallop.

phosphoric acid—an acid with a distinctive flavor that is a key ingredient in many colas and sodas.

pink salt—curing salt made with nitrites and or nitrates; pink coloring is added to prevent mistaking it for table salt.

piquillo pepper—a firm, cone-shaped, fresh red pepper from Spain.

pistachio powder—finely ground pistachios.

pistou basil leaves—fresh leaves from a variety of tiny, very aromatic basil.

plancha—Spanish word for griddle.

Pluot—(**Dinosaur egg**) the sweet, intensely flavored hybrid of a plum and an apricot. Also known as Dinosaur egg after the strange, mottled skin found on some varieties.

poke—Hawaiian raw fish dish made with candlenuts, ogo seaweed, and local sea salt.

polyglycerol polyricinoleate—(**PGPR**) emulsifier made from castor beans often used in chocolate to make it less viscous when pouring. Should not be used at concentrations above 0.4%.

polyphosphate—a family of phosphate

mineral salts with wide-ranging uses in food preparation. **Sodium tripolyphosphate** and **sodium hexametaphosphate** are often used in brines and cures; sodium tripolyphosphate and **tetrasodium phosphate** are commonly used in forced-meat preparations. Sodium tripolyphosphate, **monosodium phosphate**, and **sodium aluminum phosphate** are all excellent emulsifying salts used in reconstructed cheese products; each salt yields a slightly different texture. Polyphosphates also can function as **sequestrants** for **hydrocolloid** preparations.

Polysorbate—(**Tween and Span**) a family of powerful emulsifiers derived from **sorbitol** and fatty acids. Polysorbate 20, 40, 60, and 80 are common versions, each suited to different emulsification jobs. Polysorbate 60 and 80 are especially useful in stabilizing high fat in water emulsions and foams. Tween and Span are specific brand names of polysorbate.

pomegranate molasses—thick syrup made of boiled, tart pomegranate juice.

pomegranate seeds—(**anardana**) air-dried seeds, or arils, often used as an acidic agent for chutneys and curries. Chiefly from tart, wild pomegranates.

pomelo—giant, semisweet citrus fruit thought to be the ancestor of the grapefruit. Native to Malaysia.

pommes Sarladaise—potatoes panfried in duck or goose fat with onions, garlic, and chopped parsley. Traditional accompaniment to duck confit in southwestern France.

pommes soufflées—thin, lengthwise potato slices fried at a low temperature to dehydrate the slices, then fried again at a much higher temperature. The process makes them puff up to become light, crisp pillows.

ponzu—tangy citrus sauce used widely in Japan. Usually made with shoyu, mirin, and yuzu.

potato flour—starch powder from potatoes.

poularde—French term for a fattened pullet (young chicken or other bird) used mainly for roasting.

pregelatinized starch paste—(**prehydrated starch paste**) similar to pregelatinized starch, but not dehydrated into a powder.

pregelatinized—(**prehydrated**) some commercially prepared, modified food starches that have been gelatinized during manufacture and then dried. This makes it possible to skip the heating step to use starch as a thickener.

preserved lemon—fresh lemons that have been sliced open and rubbed with salt and spices to preserve them. Typical in Morocco and elsewhere in the Mediterranean.

pressure-fry—deep-fry in a specialized pressure cooker.

proportional-integral-derivative (PID) controller—an automated digital controller for accurate control of temperature, used in water baths, modern ovens, and high-end espresso machines.

propylene glycol alginate—(**PGA**) thickener and emulsifier. Although derived from the hydrocolloid alginate, it does not gel.

propylene glycol esters (propylene glycol esters of fatty acids)—emulsifier that is insoluble in water. Consists of various propylene glycol mono- and diesters of saturated and unsaturated fatty acids derived from edible oils and fats.

pulao—Indian term for a savory rice dish.

Pure-Cote B790—Brand name of a modified starch produced by the Grain Processing Company; used for thickening applications as well as making edible films.

quatre épices—French mix of, literally, "four spices" used in France and the Middle East. Usually made with pepper, nutmeg, ginger, and cloves, but cinnamon is sometimes substituted for ginger and allspice for pepper.

quenelle—term for an egg-shape presentation, made by transferring a soft substance repeatedly between two spoons. A variation on the name, in classical French cuisine, for poached dumplings made from finely pureed fish (traditionally pike) or meat.

quinoa—ancient, tiny, round grain originally cultivated by the Incas.

ragout—French term for a stew.

ragù—Italian term for a thick, slow cooked sauce or stew.

ramps—wild leeks, gathered in the spring; served whole or pureed.

ras el hanout—an essential North African spice mixture that can contain dozens of different ingredients, depending on the whim of the person preparing it.

red Fresno chili—medium-hot pepper like red jalapeños but with thinner walls; common in salsa. Green Fresno chili is milder.

red shallot—(**Thai shallot**) Asian small, dark pink shallot; more pungent than Western shallots.

refractometer—handheld tool that is often calibrated to gauge sugar concentration (°Brix) in liquids. Available in other versions calibrated for substances other than sugar. Traditionally used in winemaking.

render—to separate out the fat.

rennet—a collection of enzymes found in the stomachs of mammals, and some plants, that aid in the digestion of milk. The active enzyme that causes milk to coagulate, separating it into curds and whey, is called chmosin, or sometimes rennin. Animal rennet comes from the fourth stomach of young calves; vegetarian rennet is from plants, such as thistle or soybeans; microbial rennet comes from fermented microorganisms.

retort pouch—a sous vide bag that is specially designed to withstand high temperatures and is much more impermeable to gases than conventional sous vide bags.

ribose—a sugar found in meat. It is an important component in the **Maillard reaction** and the development of savory aromas in cooked meat.

rillettes—a meat spread for bread or toast, made from meat that is slowly cooked in fat and then shredded or pounded and sealed in small pots under a layer of more fat.

ring mold—(**flan ring**) heavy metal ring with rounded edges. Sold in various sizes for baking tarts and flans.

rishiri kombu—high-quality kombu from Rishiri Island at the northern tip of Japan.

roasted-coconut juice—juice of roasted green coconuts. Often sold as a beverage.

roulade—traditionally a flattened piece of meat rolled around a filling. A savory, rolled presentation. Called roulage when sweet.

royale—garnish for consommé made of decoratively cut pieces of egg-white custard.

rye berries—boiled rye kernels.
rye chops—chopped rye berries.
sabayon—(**zabaglione**) warm dessert made by gently heating and whipping together egg yolks, sugar, and wine, traditionally Marsala.
sablé—crumbly French cookie from Normandy that can be flavored with almond or citrus zest. Sometimes modified to become a savory cookie or cracker.
sachet—pouch of porous cloth, such as muslin, or paper to hold ingredients that will be steeped in liquid.
salmis—rich stew made with the carcass meat of game birds or duck, cooked down to a puree with butter and onions and then thickened with a roux. Traditionally served on toast using the leftovers from a roast bird.
salsify—a long, narrow root vegetable with black or grey skin and white flesh. Sometimes said to have a mild seafood flavor.
salted pollock roe—see **bottarga**.
salted shrimp—a Korean condiment consisting of tiny, brined shrimp. Used like **fish sauce**.
sambal bajak—dark, rich, Indonesian condiment of chilies fried in oil with garlic.
sansho pepper—see **Szechuan pepper**.
sauce gun—funnel dispenser often used in confectionery work.
sauce ravigote—French piquant sauce similar to a rich vinaigrette, or a velouté brightened with lemon or vinegar. Often with sautéed shallots or onions, capers, and herbs. Served warm or cold.
sea bean—(**samphire, glasswort**) succulent, very salty coastal plant served as a crunchy salad green, vegetable, or garnish. Often soaked or blanched to make it less salty.
sea urchin tongues—(**uni**) sacs containing the edible gonads of sea urchin. Each spiny, globular sea urchin has five plump tongues that radiate like spokes on a wheel in the interior chamber of the animal.
semolina flour—finely ground, hard, yellow, durum wheat. The basic ingredient of most Italian pasta and couscous.
sequestrant—a chemical used to remove (sequester) ions from solutions. Most often used to remove calcium and magnesium ions to allow **hydration** or to prevent premature gelling of **hydrocolloid** gums such as **sodium alginate**, **pectin**, and **gellan**.
sev—crispy, fried vermicelli from India, made from chickpea flour.
seviche—(**ceviche**) preparation of fish or seafood "cooked" by marinating it in an acidic citrus juice such as lime.
shabu-shabu—Japanese hot pot meal where thin slices of raw meat and seafood are dipped in a hot, flavorful broth to lightly cook; served with a sesame-based sauce.
Shaoxing—one of the most famous Chinese rice wines, originating from the eastern province of Shaoxing; similar to dry sherry.
shear—to blend or mix by stirring.
shimeji—(**hon shimeji**) beech mushroom.
shishito pepper—type of mild, fresh, Japanese green pepper. Typically served grilled with salt.
shiso—Japanese term for perilla, an intensely flavored annual with jagged edges in the mint family. Widely used in Japanese sushi, sashimi, tempura, and salads.
shoyu—Japanese term for soy sauce.
shrimp cracker puffs—crisp, puffy fried crackers made from wafers of starch (usually tapioca) and shrimp paste. A popular Indonesian snack food.
shrimp paste—(**belacan, gapi, kapi**) fermented ground shrimp sold in blocks. An important seasoning in many South Asian dishes. Available in many varieties and names.
Sicilian pistachios—bright green and revered for their flavor. The Italian pistachio nut is often sold shelled.
silver powder—edible powder made from mica and used for garnish and presentation; true silver is not approved for use in food.
Simplesse—brand name for a product made by CP Kelco from whey protein. Used to modify food textures to simulate the richness and mouthfeel of fat.
Sichuan chilies—red, dried, fragrant, mild chilies, unrelated to the chili pepper or black pepper. Indispensable in Szechuan cooking.
Sichuan peppercorns—(**sansho**) dried berries from the Chinese prickly ash that have a slightly hot, lemony flavor and a slight mouth-numbing effect.
slurry—a pourable mixture of solid particles dispersed, but not dissolved in a liquid.
Smithfield ham—traditional cured, hickory-smoked, and dried American ham from Smithfield, Virginia, and neighboring areas.
smoke gun—handheld miniature smoker, similar in size to a tobacco pipe, that can be used to direct smoke onto foods to enhance flavor or presentation. Several manufacturers produce these, including Polyscience.
smoked Hungarian cherry peppers—small, sweet, smoky, dried peppers.
soccarat—flavorful, crispy rice crust that forms at the bottom of a paella pan, prized for both its flavor and texture.
sodium alginate—**hydrocolloid** that gels in the presence of ions such as calcium and magnesium. Several grades with differing viscosities are available.
sodium bicarbonate—baking soda, a leavening agent.
sodium caseinate—principal protein in milk. Can function as a powerful emulsifying and foaming agent. Under the right conditions it will gel, which is essential for cheese making.
sodium citrate—the salt of citric acid. Often used as an emulsifier in reconstructed cheese products. Used to impart a tart taste to many beverages. Also functions as a preservative.
sodium erythorbate—very potent antioxidant. In the U.S., bacon cures that use nitrite salts must incorporated it to minimize the creation of toxic nitrosamines when the bacon is fried or otherwise browned.
sodium hexametaphosphate—a **polyphosphate** often used as a **sequestrant** that is helpful in controlling calcium and other ion concentrations when working with certain **hydrocolloids**, including **sodium alginate**, LM **pectin**, and **gellans**.
sodium hydroxide—alkali salt, also known as lye. Used in curing some lutefisk and olives.
sofrito—fried mixture of oil, onions, green peppers, and garlic that is considered the backbone of Latin cooking.
soldiers—English term for bread slices cut into sticks; typically dipped in the warm yolk of a soft-boiled egg.

sorbitan esters—see **polysorbate**.
sorbitol—sugar alcohol used as a texture modifier and emulsifier.
sorrel, garden—leafy, tender green with a bright, lemony flavor. Used in herb mixes, salads, and (when pureed) some sauces.
sorrel, Indian—a small, bushy herb with a slightly bitter, very acidic flavor.
sorrel, wood—(**oxalis**) cloverlike, tender green herb with tangy citrus flavor.
sous vide—a French term that literally means "under vacuum," but is more accurately interpreted as "without air." Cooking sous vide often, but not always, involves hermetically sealing food in flexible plastic bags and then cooking it at a carefully selected combination of temperature and time.
soy lecithin powder—(**deoiled lecithin powder**) emulsifier and foaming agent usually derived from soybean. It is particularly good for making coarse and dry foams.
spätzle—German dumplings usually formed by sieving a soft dough into boiling water. Often fried in butter after boiling.
spherification—technique of turning liquids into gelled spheres, small or large, using hydrocolloids that will gel only in the presence of various ions, such as calcium. There are several variations on the fundamental technique.
spot prawn—(**Alaska spot prawn**) variety of large, sweet, cold-water shrimp with characteristic white spots on a pink shell. Found in the North Pacific.
spray-dried—powders formed by bulking up liquids and processing in a spray dryer.
spring garlic—garlic that is picked in the spring, when it is still very tender and mild, not fully matured or dried.
Sriracha sauce—thick, red sauce made with chili and garlic. Often used as a condiment.
ssamjang—a thick spicy paste of chilies, fermented Korean soybean paste, and seasonings. A condiment in Korean barbecue.
sticky rice—high-gluten, short-grain rice that is often naturally sweet.
sucrose esters—emulsifiers derived from sucrose. Often used in beverages and confectionery.
sumac—dried fruit of the sumac shrub. Ground and used as a tangy, slightly astringent spice, popular in the Middle East. Often seen sprinkled on hummus.
supreme—French term for a breast of chicken, duck, or other bird with the wing bone attached. It can also refer to a meat product with bone, skin, and other extraneous parts removed. It is sometimes used by analogy to describe citrus segments served without the skin, pith, membrane, or seeds.
sushi-quality—seafood that is so fresh it can be eaten raw, ideally "from the water today."
sweat—to cook vegetables slowly in a minimal amount of fat, at low temperatures, so that they will soften without browning.
sweet whey powder—byproduct of the manufacture of cheeses, such as cheddar and Swiss. Sweetness comes from lactose sugar that is drained away with the whey during cheese making.
syneresis—weeping. The separation of a liquid contained by a gel due to some form disruption to the molecular structure of a gel. Warming, freezing, compression, and incompatible ingredients are just a few ways to trigger syneresis.
tagine—(**tajine**) spiced Moroccan stew often served with couscous.
tagine slaoui—earthenware stewing pot with a tight-fitting cone-shaped lid used in making tagines.
tahini—oily paste of toasted, ground sesame seeds.
tajarin—long, thin, rich egg noodles from the Piedmont region of northwestern Italy.
takoyaki—Japanese fried, round dumpling made with savory batter and cooked octopus.
tamago—Japanese sweet, firm, layered omelet often served as nigiri sushi.
tamari—a dark, rich-flavored soy sauce that is made with little or no wheat.
tamis—very fine mesh cloth used as a sieve.
tannin powder—a blend of components including tannic acid and the pigment enocianin isolated from red grape skins.
tapenade—traditional Provençal paste of olives, capers, garlic, and anchovies. Can also apply to a flavorful savory condiment similar in texture to a classic tapenade.
tapioca pearls—beads or marbles of tapioca cooked until they are tender but chewy with a mildly slick quality. Commercially available in various colors and sizes.
tapioca starch—purified starch taken from the root known as manioc, cassava, or yucca.
Tarbais beans—white bean from Tarbes, near the French Pyrenees. Essential in classic French stews such as cassoulet.
tartaric acid—powdered acid most often derived from grapes. Used as an acidifier and antioxidant, and sometimes to prevent crystallization in sugar syrup by converting some sucrose to noncrystallizing glucose.
temper—various culinary meanings include heating slowly and gently, and progressively warming a mixture by adding a hot liquid. In chocolate making, it is the process of heating and working the chocolate to manipulate the crystal structure of the cocoa fat to help produce a characteristic snap and melt-in-the-mouth quality.
Texturas-style syringe—large syringe for dispensing droplets. Product from the Texturas line created by elBulli restaurant.
Thermomix—a heavy-duty blender that is capable of heating while it blends, or purees.
thermophilic cultures—organisms used to create distinct flavors in cheese and yogurt. Thermophilic cultures thrive at 45–80 °C / 113–176 °F. Incorporated into commercially available fermentation starter cultures.
thixotropic—the property of some thickened liquids or fluid gels to become less viscous when shaken or sheared. Also known as shear-thinning. **Hydrocolloid** thickeners are often thixotropic to some degree, and **fluid gels** are highly thixotropic.
titanium dioxide—white food coloring.
tobiko—Japanese term for the roe of flying fish. Often used in sushi.
Tonka beans—aromatic seeds from a tree native to South America. They have heady aromas reminiscent of vanilla, almonds, and cinnamon. They are banned for use in food in several countries, including the U.S. because the seed contains coumarin (also found in cassia bark or cinnamon) which can

be toxic to humans in large doses.

torchon—a method of preparing foie gras, traditionally by rolling it into a cylinder using a kitchen towel (torchon in French) and then poaching the rolled foie gras. Usually sliced and served cold.

transglutaminase—See **Activa**.

trehalose—(**tremalose**), a sugar found in plants that help them survive droughts. In cooking, it is a useful sugar because it is only mildly sweet and does not become sticky in a humid environment. Also used as a source of dissolved solids for various preparations including gels, edible films, sugar work, savory ice creams, and more.

Trisol—soluble modified wheat product from the elBulli Texturas line, especially effective at producing crunchy batter-coated, deep-fried foods that are less oily.

turbot—large North Atlantic flatfish prized for the quality of its flesh.

Tween—see **polysorbate**.

Ultra-Crisp—modified food starch made by National Starch. Effective for making very crispy, batter-coated fried foods.

ultrahigh-pressure homogenizer—very powerful tool used to make extremely fine particles or droplets in suspensions or emulsions.

Ultra-Sperse—a **pregelatinized** modified starch made by National Starch. Can be stirred into a cold liquid to thicken it quickly.

Ultra-Tex—a **pregelatinized** modified starch made by National Starch. Used as a thickener. Requires moderate shearing to disperse it in a cold liquid.

umami—the savory taste of the amino acid glutamic acid, or its salt monosodium glutamate. Naturally occurring at high concentrations in a wide variety of foods, including milk, cheese, tomatoes, mushrooms, and especially seaweed.

unhomogenized milk—milk that has not been homogenized; the cream in unhomogenized milk separates and floats to the top.

usukuchi shoyu—light soy sauce with a pale golden color and light flavor.

veil—a very thin drape of gel or edible netting often used for unique presentations.

velouté—one of five French "mother sauces;" a savory liquid thickened with a light or blond roux.

verjuice—(**verjus**) tart juice of unripe grapes, used as an acidifier and flavor enhancer.

Versawhip—brand of foaming agent and foam stabilizer.

vin jaune—French for "yellow wine." A wine similar to fino sherry but not fortified.

vital gluten—(**gluten flour**) prepared by using cold water to wash away the starch in a dough prepared from gluten-containing dough. The extracted gluten actually contains two proteins, glutenin and gliadin, that together give a dough its strength and elasticity. As a commercial product, vital gluten can be used to add strength, or "bite," to noodles or improve the texture of bread.

Wagyu beef—(**Wagyū**) several cattle breeds of Japanese origin that yield highly marbled meat. Wagyu beef has become synonymous with prized Japanese Kobe beef.

walnut leaves—leaves of the walnut tree with a bitter, astringent taste. Often pickled.

wet-bulb temperature—temperature of a wet object in equilibrium with the surrounding air. If the relative humidity of the air is less than 100%, then the wet-bulb temperature will be lower than the **dry-bulb temperature** because of evaporative cooling. Food exposed to air typically cooks at the wet-bulb temperature for much of its cooking time. Wet-bulb temperature is measured using a thermometer that is kept wet with a wick.

whey protein concentrate—concentrated whey protein that contains lactose sugar. Can be used as an emulsifier, foaming agent, thickener, and gelling compound.

whey protein isolate—concentrated whey protein that has the lactose sugar removed. Can be used as an emulsifier, foaming agent, thickener, and gelling compound.

whey—the liquid that remains when milk has coagulated and the curds are removed. Among other compounds, it contains the protein whey and the majority of the lactose sugar that was in milk.

White Lily biscuit flour—brand of soft wheat flour with a low protein content and a low level of damaged starched (from the milling process) that yields especially tender biscuits, cookies, and other baked goods popular in the American South.

White Lily bread flour—brand of soft wheat flour with a moderate protein content suitable for some types of tender breads, such as rolls, popular in the American South.

white poppy seeds—hard, off-white seeds used in Indian, Middle Eastern, and Asian cuisine to add thickness, texture, and flavor to sauces. Flavorful oil similar to olive oil can be pressed from them.

white soy sauce—golden, thin variety of soy sauce.

wild watercress—an edible, slightly bitter green that has been collected from a safe water source.

wild wood violets—young leaves and blossoms of the viola plant with a mild cucumber taste. Used as a salad green.

winepress—a perforated vat that uses a compression plate and a screw or jack to apply enough force to crush grapes and expel their juice. Classically used to extract juices from cooked duck and lobster carcasses.

Wondra—wheat flour treated to prevent clumping and used for thickening. Made by General Mills.

xanthan gum—thickener with thixotropic behavior that will also gel when used in combination with locust bean gum. Works over a wide temperature and pH range, making it a versatile hydrocolloid.

XO sauce—Chinese condiment made with chilies, garlic, and dried seafood.

young ginger—freshly picked ginger rhizomes, with thin skin and bright flavor.

young lotus root—immature root from the lotus plant. More tender than mature lotus.

yuba—tofu or soy milk skin collected from boiled soy milk. Often dried, then reconstituted and used as an edible wrapper or textural element.

yuzu—aromatic, tart, Japanese citrus fruit. Often used to make the dipping sauce ponzu. Salted yuzu juice is called **yuzu kosho**.

GLOSSARY OF TECHNICAL TERMS

1D reduction or process—a process that kills or inactivates a population of pathogens to one-tenth of its original number; or a 90% reduction.

6.5D, 12D—reducing pathogens by a factor of 106.5 (or 3.2 million, for 6.5D) or a factor of 1012 (or one trillion, for 12D), which is the degree of pasteurization recommended for canned foods with a low acid content.

absolute—a concentration of oil extracted from a flower made by removing the resin from an oleoresin.

accuracy—how close an instrument's reading is to the true value of what is being measured. Note that accuracy is different from precision.

acidulant—a chemical that increases the acidity of foods.

acrylamide—a by-product of the Maillard reaction; suspected of being a carcinogen.

actin—muscle protein used for contraction.

activity coefficient—a measurement based on the difference between the concentration of a substance and its activity.

activity—what appears to be the concentration of a substance (as opposed to its actual concentration), based on its behavior.

adrenaline—a hormone produced by the adrenal gland in vertebrates; when secreted in response to stress, adrenaline increases the heart rate, blood pressure, respiratory rate, and release of stored glycogen, which provides fuel for sudden bursts of physical activity or increased alertness. Also known as epinephrine.

adsorb—to adhere to the surface of a substance without penetrating it.

aerobic—organisms or processes that require oxygen to live or occur.

allicin—a sulfurous compound produced when garlic is crushed or cut. This compound is part of garlic's characteristic flavor and has potent antimicrobial properties.

amebiasis—infection with the single-celled protozoans of the genus Amoeba.

amine—an organic compound derived from ammonia by replacing hydrogen with one or more organic groups.

amino acid—one of the chemical building blocks from which proteins are composed. Virtually all proteins are made from a repertoire of just 22 kinds of amino acids.

anaerobic bacterium—a bacterium that does not require oxygen to survive.

anaerobic—living or occurring without oxygen.

anaphylaxis—an acute, often life-threatening allergic reaction to a particular agent or substance.

androstenone—a pheromone produced by many mammals that is also a key aroma compound in truffles.

anisakid—a parasitic roundworm in the Anisakidae family, often found in the flesh of inshore salt water fish.

antifoaming agent—a substance that decreases the surface tension of an agitated liquid to stop foam from forming.

antioxidant—any compound that inhibits oxidation reactions such as the browning of cut apple slices.

Archaea—a group of simple microorganisms that appear similar to bacteria but have a distinct genetic and biochemical makeup.

aspirator or **aspiration vacuum pump**—a vacuum pump that uses flowing water—either from a faucet or in a pumped, recirculating system—to generate suction.

astaxanthin—a violet **carotenoid pigment** that is found in particular bird feathers and crustacean shells.

bacteria (singular bacterium)—a large group of single-celled microorganisms that lack a nucleus or chlorophyll.

bacterial spore—a structure created by bacteria that is capable of weathering an unfavorable environment.

bacterial toxin—a substance produced by bacteria that is poisonous.

ball mill—a device used to break up hard, dry foods by crushing it between constantly rotating spheres.

bang-bang controller—a controller that automatically switches between two states, such as off and on.

Biot number—a figure representing the ratio of the heat transfer rate occurring on the outside of an object to the rate occurring inside that object.

bis-2-methyl-3-furyl-disulphide—a potent aroma produced by the Maillard reaction and associated with the flavor of roast beef.

bitters—a liquor flavored with essential oil extracted from bitter plant material, such as bitter herbs.

bivalve—a mollusk with a two-part shell.

blackbody radiation—thermal waves of radiation emitted at a fixed temperature from an ideal body that absorbs all the radiation it is subjected to and that reflects none of it.

blast freezer—a device used to quickly freeze an object, such as a food, at extremely low temperatures by circulating cold air around the object at high speeds with a fan.

blonding—in making an espresso shot, the last stage in which the resulting liquid turns light yellow, increases in frothiness, and begins to taste bitter.

Bloom—a measurement of the strength of a gelatin gel with a device created by Oscar Bloom.

boundary layer—a region of stagnant air or water around the surface of an object. The boundary layer often slows the rate of heat transfer or drying. Forced convection shrinks the thickness of the boundary layer.

bovine spongiform encephalopathy (BSE)—a degenerative brain disease of cattle in which the brain tissue becomes porous, leading to dementia, loss of muscle control, and death. It is caused by prions.

braise—slow-cooking food (usually meat) in liquid or humid air in a closed vessel.

Brettanomyces (brett)—a yeast genus; brett species are used to create flavors in alcoholic beverages; if not properly contained, they can cause such beverages to spoil.

brewing control chart—a graph used to quantify how dosing and brewing time affect the taste of brewed coffee.

brining—soaking meat or other food in a salt solution; helps retain water during cooking

British thermal unit (BTU)—an energy unit representing the amount of heat needed to raise the temperature of 0.45 kg / 1 lb of water without dissolved air by 0.6 °C / 1 °F.

bromelain—an enzyme found in pineapple juice that breaks down protein and is used as a meat tenderizer.

bromophenol—volatile compounds (produced by, among other things, seaweed) that contribute to the smell of the seaside. These compounds accumulate in some seafood and add to their flavor.

Brownian motion—the random movement of microscopic particles suspended in a liquid or a gas.

Büchner funnel—a funnel used to hold filter paper for **vacuum filtration**.

bulk phenomenon—a phenomenon, such as absorption, that affects all parts of a body.

burr grinder—a device used to break up hard, dry foods that, uses the rotation of two burrs with evenly spaced notches to crush the food. This produces a more uniform size distribution than other grinders.

caffè crema—the last stage of an espresso shot "pulled" for a longer than typical time to produce a larger volume of liquid.

calorie—in thermodynamics, an unit of energy equivalent to the heat needed to raise the temperature of 1 g / 0.04 oz of water by 1 °C / 1.8 °F at 1 bar / 14.7 psi of pressure. In nutrition, the term is often used to mean a kilocalorie (1,000 calories).

calpain—a class of enzymes that are important in making meat tender because they catalyze the breakdown of protein. They require calcium to function.

capsid—the protein shell that surrounds a virus.

carbon filtration—a method of filtering a liquid or gas by passing it through porous carbon. Sometimes called charcoal filtering.

carbonation—the process of dissolving carbon dioxide gas into a substance. It is common in beverages and soft drinks, but solid foods can also be carbonated.

carbonyl—a broad class of organic chemical compounds, many of which are important aroma compounds in food and play a key role in the chemistry of smoking food.

carotenoid pigment—yellow, orange, red, or purple pigments in plants and animals. They are prone to oxidation and often degrade into flavorful compounds during cooking.

carrageenan—a hydrocolloid derived from seaweed, such as Irish moss, that is used to thicken a gel or a liquid.

catalysis—a change in a chemical reaction rate caused by a substance (called a catalyst) that isn't altered by the reaction.

cathepsin—a protein-digesting enzyme present in most animal tissue. Cathepsin promotes the self-digestion of cells in response to certain diseases and after the irreversible loss of vital functions.

cavitation—the formation of void- or vapor-filled bubbles in a liquid via a fast-moving solid object, such as a propeller, or via sound waves. The collapse of the bubbles creates strong shock waves.

centrifugal-style juicer—a mechanism that extracts juice from food by cutting it up in a chamber whose rapid spinning causes the juice to separate from the solid pulp.

centrifuge—a mechanism that rapidly spins liquid, causing substances with different levels of density within it or solid material dispersed and suspended within it to separate.

chamber sealer—a device used for vacuum-packing food in plastic bags. It includes a pump (for evacuating air from the chamber) as well as one or more sealing bars that melt the open end of the bags closed once nearly all of the air has been removed.

Champion-style juicer—a fruit and vegetable juicer that grinds food with spinning teeth and wrings juice from it.

chaptalization—the process of adding sugar to grape juice to ensure the proper alcohol content.

chlorophyll—a green pigment found in plants that is necessary to photosynthesis.

chlorophyllase—an enzyme that causes chlorophyll to split or hydrolyze, which causes discoloration in many plant foods.

cholesterol—a molecule from which bile acids and steroid hormones are formed. A key constituent of cell membranes that affects their permeability, cholesterol is found in the cells and body fluid of all animals.

chronic wasting disease (CWD)—a degenerative brain disease of deer, elk, and moose in which the brain tissue becomes porous, leading to dementia, loss of muscle control, and death. Thought to be caused by prions.

circulating bath—a temperature-controlled container of water that is pumped so that it circulates and thus distributes heat evenly. It is used to cook sous vide and is also known as a stirred bath.

citrus press—a mechanism for extracting juice from oranges and similar fruits. Typically this works by forcing a half-orange against a mandrel (which sometimes spins).

climacteric—a stage in fruit ripening stimulated by ethylene gas, which can occur after the fruit is picked.

coagulant—an agent that causes a liquid to thicken into a gel or a solid. Often this occurs by making molecules in the liquid (such as proteins, or hydrocolloids) cross-link or bond.

coalescence—the process by which distinct objects (such as droplets in an emulsion) merge to form one larger object.

cold shortening—a phenomenon in which the muscle of a carcass that was cooled too rapidly irreversibly contracts, causing it to shorten dramatically after rigor sets in. Makes the meat unpleasantly tough to eat.

collagen—a fibrous protein that is present in all animals and is the major component of connective tissue.

collapse temperature—see **critical temperature**.

colloid mill—a machine that breaks down the pieces of an emulsion or paste into smaller particles.

colloid—two dissimilar phases dispersed evenly through one another. One phase is the dispersed phase, and the other is the continuous phase. A phase may be a solid, a liquid, or a gas. An emulsion is an example of a liquid dispersed in a liquid, and an aerosol is a liquid dispersed in a gas. When

particles are dispersed in a liquid, the result is sometimes called a colloidal suspension.

colony-forming unit (CFU)—a unit of a microorganism capable of reproducing the cells of that organism and thus forming a colony of such cells.

combi oven—an oven capable of cooking by means of heated air distributed with a fan (as convection ovens do), steam injected into the cooking chamber, or both.

combination mode (or combi mode)—an available mode in a combi oven in which both the dry-bulb temperature and the humidity can be independently controlled to achieve certain culinary effects.

combust—to produce heat and often light via very rapid oxidation.

comminution—physically reducing an object to smaller pieces.

conching—the process of refining the texture of chocolate by wet-milling it in a conche machine (a machine much like a rotating mortar and pestle).

concrete—see **oleoresin**.

condensate—the product of the transition of a material from a gas state to a liquid one.

conduction—heat transfer that occurs through energy exchange between particles.

confidence interval—a measure of the reliability of an estimate in a statistical study, particularly a medical study involving a sample of a larger population. Most results are quoted with a 95% confidence interval, which gives the range in which the estimate would be expected to fall 95% of the time if the study were done repeatedly.

conformation—a three-dimensional molecular shape, such as the functional shape assumed by protein after it is synthesized.

confounding effect—a situation in which either or both of two different variables may explain a statistical characteristic.

conservation of mass—a fundamental physics principle stating that mass cannot be created or destroyed.

constant-rate period—the first phase of the drying process. In this phase, water is wicked to the drying surface at the same rate at which it evaporates from the surface.

constructed cream—a cream derived via emulsification from a liquid that does not naturally form cream.

continuous phase—the phase in an emulsion or colloid in which a liquid suspends solid material or scatters droplets of another liquid.

convection current—a moving stream of fluid created by convection.

convection oven mode—a combi oven mode in which the oven is set to the properties of a convection oven.

convection oven—an oven that distributes heated air with a fan.

convection steaming—cooking food in a water-vapor oven or combi oven or dedicated steamer using steam inserted into the cooking chamber and distributed with a fan.

convection—heat transfer that occurs within a fluid because of the movement of particles within the fluid.

corked—the attribute, in wine, of having contracted unwanted taste or odor via contact with a contaminated cork. Also known as cork taint.

covalent bond—a chemical bond formed by two electrons, one contributed by each of the two bound atoms.

creaming—one of the failure modes of an emulsion, where the lighter oil phase rises to the top, as occurs with cream in unhomogenized milk.

crema—the layer of reddish-brown or golden foam on the top of espresso coffee.

Creutzfeldt-Jakob disease (CJD)—a degenerative brain disease of humans in which the brain tissue becomes porous, leading to dementia, loss of muscle control, and death. It is caused by prions.

critical point—the point at which two phases (such as gas and liquid) become one supercritical fluid.

critical temperature—in freeze-drying, the maximum temperature that can be allowed during certain stages of the process, also called the collapse temperature. In the context of a phase diagram it can refer to the temperature of the critical point.

cryoconcentration—a wine production procedure of removing excess water from grape juice by cooling it the point that ice crystals form. Also see freeze concentration.

cryogen—a substance used in cryogenic freezing to bring an object's temperature down to a very low point, generally below −150 °C / −238 °F. The most common cryogen in cooking is liquid nitrogen.

cryopoaching—a cooking technique in which food is immersed briefly in a cryogen, usually liquid nitrogen.

cryosearing—a cooking technique in which liquid nitrogen or dry ice is used to protect the cooking of the interior of a food from overcooking while the exterior is seared with high heat.

cryospherification—a method of spherification in which liquid frozen in a mold is placed in a bath of hydrocolloids, where its outer layers gel as they thaw. When frozen in a mold, it is also called molded spherification.

curd—the thickened milk gel that has been treated with a coagulant to make cheese.

curing—soaking meat in a chemical solution (or rubbing dry chemicals on it) to induce changes in texture, flavor, and color.

CVap—a brand of water-vapor oven that allows the wet-bulb temperature and the dry-bulb temperature to be set independently to some extent.

cyanobacterium—a member of a group of water-based organisms ranging from one to many cells; also called blue-green algae.

cysteine—a sulfur-containing amino acid; an important contributor to meat flavor.

cytochrome—respiratory pigments in the cells of plants and animals that carry electrons during oxidation.

dark cutter—red meat, especially beef, that fails to turn red on contact with air and displays a dry firm dark property.

decoction—removing flavor from a substance by boiling it.

degrees of freedom—a term from physics that counts the number of dimensions in which a body's constituents might move or in which changes might occur in a system.

dealcoholization—the process of removing unwanted alcohol content from an alcoholic substance, such as wine, after fermentation has occurred.

deionized water—water that has been

purified by a process in which its mineral ions are entirely removed.

deliquescence—the process by which a solid with a crystalline structure absorbs water vapor in the atmosphere then dissolves.

denaturing—the unfolding of a protein, which makes it nonfunctional. High and low temperatures, changing pH, high salt levels, and the addition of solvents such as alcohol can all denature proteins.

deoxymyoglobin—a form of myoglobin that lacks oxygen.

derivative—a term from calculus for the rate of change in a mathematical function.

desiccant—a substance, such as silica gel, that readily absorbs moisture. Desiccants are used to keep dry food dry.

dew point—the temperature at which the moisture present in air begins to condense into dew on surfaces.

dietary fiber—material present in food that is not broken down by human digestive systems.

dietary system—a set of rules that determines which foods and liquids that a person following the system consumes.

differential scanning calorimeter (DSC)—an instrument that measures the change in temperature of a substance as it is heated. It is used to determine chemical and phase changes in the substance.

dipole—a material or object having two electric charges that are equal and opposite. In molecules, this is caused by having an uneven distribution of electrons.

dispersed phase—the phase in a dispersed system in which one system's particles or droplets are distributed into another system.

dispersed system—a system consisting of a dispersed phase and a continuous phase, in which a liquid suspends solid material or scatters droplets of another liquid.

disperse—to distribute finely divided particles into another substance.

distillation—the separation by evaporation of two liquids with different boiling points. It is often used for purification.

DNA (deoxyribonucleic acid)—a double helix of two nucleic acid strands that carries the genetic information of living organisms and certain viruses.

dose standard—the standard quantity of a material added to a substance, such as the standard ratio of coffee beans to water in particular kinds of coffee.

dosing—the act of applying the proper proportion of a material to a substance. In espresso making, dosing is putting the proper amount of coffee into the portafilter.

double-blind trial—an experiment in which both subjects and researchers are unaware of who is in the test group and who is in the control group.

draft—a pressure difference between the inside and the outside of a closed space that creates air flow.

dry firm dark (DFD)—a property of meat, especially beef, in which an animal's muscles are exhausted of energy reserves in the form of glycogen, resulting in dark meat with a higher pH than normal and a dry, firm consistency.

dry-bulb temperature—a temperature measurement of air. Unlike the wet-bulb temperature, humidity in the atmosphere is not a factor in the measurement.

dry-curing—see **curing**.

dry-rubbing—rubbing sugar or seasonings into meat to improve flavor and retain water.

dynamic viscosity—a measurement of the **viscosity** of a fluid based on the force needed to move a plane across a certain amount of space with a specific velocity relative to a parallel plane within that fluid.

ecological study—in epidemiology, a study of the health effects on a population done only via aggregate statistics of the population. This kind of study generally provides less reliable information than cohort or case-control studies, which collect information about individual subjects.

efficiency—the amount of useful work a device produces during a time period expressed as a fraction of the amount of energy required to operate it during that period.

elastin—a protein that is found in some connective tissue. It is extremely tough and elastic and unaffected by cooking.

emetic—a substance that causes vomiting.

emulsification—the act of creating a mixture of two normally immiscible liquids, often with the aid of an emulsifier.

emulsifier—any compound that stabilizes a mixture of two otherwise immiscible liquids.

emulsion—a mixture of two normally immiscible liquids, such as oil and water.

endemic—the quality of a disease-causing agent that is always to be found in a particular region.

endomysium—a layer of connective tissue that encases individual muscle fibers.

energy—in physics, the capacity for doing work.

enfleurage—the process of using fat layers to absorb volatile compounds that are responsible for a botanical compound's scent, then extracting those oils from the fat, usually via distillation.

enthalpy—a heat quantity derived by adding a system's internal energy to the pressure exerted on the system multiplied by the product of its volume.

envelope—a lipid- or lipoprotein-based membrane that envelops the capsid of certain viruses.

enzyme—a protein molecule that catalyzes chemical reactions of other substances but isn't destroyed or altered in the process.

epimysium—the sheath of connective tissue that surrounds a muscle.

equilibrium cooking—cooking with a heat source (such as a water bath for sous vide) which is at or very close to the final desired food temperature. The food is allowed to equilibrate with that temperature.

equilibrium relative humidity—a state in which a material's moisture content is the same as that existing in the air, meaning that the material will not gain or lose moisture. It is equal to the food water activity.

equilibrium vapor pressure—the vapor pressure that is exerted in a system in which at least two water phases (such as liquid and vapor) are in equilibrium.

equilibrium—a state in which no change occurs because of the balance between opposing forces or rates of reaction.

essential oil—concentrated flavor and compounds extracted from plants.

evaporation—the heat-induced change from liquid to vapor.

evaporative cooling—a drop in the

temperature of air caused by the presence of **evaporation**—usually of water.

evapotranspiration—the exodus of water from the planet's surface caused by the evaporation of bodies of water and the process by which plants expunge water as vapor from their surfaces.

exponential growth—growth that increases at a constant rate, such as when cells divide at a rate in which the cell population doubles each time division occurs. Also known as geometric growth.

exsanguination—the process in which an animal carcass is drained of blood.

extender—a substance used to add protein to meat, such as to promote the emulsification of fat or the binding of ground meat.

extracellular fluid—fluid that exists outside of a cell.

extraction percentage—the percentage of material in a substance that can be removed.

extraction—the removal of material from a substance that contains it, such as by means of a solvent.

facultative anaerobe—a microorganism that can function with or without oxygen.

falling-rate period—the final phase of the drying process. During this phase, water inside the substance is so tightly bound to molecules in the food that the rate of evaporation slows dramatically.

fascicle—larger bundles of muscle fibers that define the grain of a cut of meat.

fatty acid—the chemical term for the acidic lipid compounds that cooks commonly refer to as fat.

fecal load—the number of infectious organisms present in 1 g / 0.04 oz of infected feces.

fecal–oral route—the process by which a pathogen travels from the feces of an infected organism to a new host via food contamination.

femtogram—one quadrillionth of a gram.

fermentation—the modification of a food by the deliberate growth of microorganisms in it, such as yeast with wine or bread or Lactobacillis with yogurt.

Fick's first law of diffusivity—a law stating that molecules of matter will diffuse (move randomly) from areas with a high concentration of them to areas with a low concentration of them at a rate proportional to the concentration difference.

film condensate—a thin layer of water. It is created by the condensation of steam and tends to slow further heat transfer.

fish eye—lumps formed from incomplete dispersion of a starch or hydrocolloid gum in water.

flagellum—a long, thin appendage used for locomotion by single-celled organisms.

flash-boiling—a cooking technique in which a small amount of water boils for a very short time before evaporating entirely.

flash-freezing—a process in which an object, such as a food, is frozen quickly by subjecting it to extremely cold temperatures.

flocculation—the process by which a substance is made to form into clusters.

fluid gel—a gel in which the gel structure has been broken, enabling it to flow like a liquid.

fluidized bed freezing—a technique in which an object, such as a food, is frozen by blowing extremely cold air up through porous material on which the object rests.

foam stabilizer—a substance used to prevent foam from dissipating.

foaming agent—a substance used to create foam.

foam—the bubbles that compose a frothy mass. They are formed on a liquid's surface by agitating it or by subjecting it to a chemical process.

food poisoning—an illness caused by toxins produced by bacteria in food.

food press—a mechanism to extract juice from food by mechanically pressing it between two plates or between a pestle and a cone with holes in it.

foodborne pathogen—a disease-causing agent that infects the body via food.

forced convection—heat transfer that occurs when a fan or pump is used to move a hot fluid (such as air or water) across a food.

foreshots—the condensate material produced in the first stages of a distillation.

freeze concentration—a method of removing excess water from a liquid by freezing out some of the water as ice.

freeze-drying—a method of drying a frozen material, such as a food, by sublimating ice into water vapor. Freeze-drying is done by freezing the material, then subjecting it to a high vacuum, which causes the ice to vaporize without melting first.

freezer burn—the phenomenon in which spots of discoloration appear on frozen food when improper wrapping has allowed moisture to escape by sublimation.

freezing point depression—the lowering of the temperature at which a solution will freeze by dissolving a substance such as salt, sugar, or alcohol in it.

frequency—how often a periodic event repeats within a given interval of time.

friction—the force resisting relative motion between two bodies in contact.

frozen set foam—foam made solid by freezing to prevent it from dissipating.

fusel alcohol— alcohols with more than two carbon atoms. These are formed during fermentation, and concentrated by distillation where they occur in the tails of the distillation process.

gas saturation—the point at which no more gas can be dissolved into a solution.

gastroenteritis—inflammation of the stomach and intestinal membranes.

gelatinization (of meat and seafood)—the process of tenderizing otherwise tough connective tissue in meats and seafood by cooking them at an adequately high temperature and with enough moisture. The process involves the shrinking then dissolution of collagen via hydrolysis.

gelatinization (of starch)—the result of heating starch granules in the presence of water, thereby causing them to lose their semicrystalline structure as they swell with water. The temperature range over which this occurs is characteristic of a starch's botanical origin.

genome—the entire collection of a species' genetic hereditary information.

genus—species that are closely related, and thus considered a group.

geometric growth—see **exponential growth**.

geosmin—a chemical produced by a bacteria of the order Actinomycetales that is responsible for the "earthy" smell of soil. It is found in beets, baby corn, many bottom-dwelling fresh water fish, and other foods.

glass transition temperature—the temperature at which a liquid becomes a solid without an ordered crystalline structure. Spun sugar (cotton candy), for example, is a glass, whereas crystalline sugar is not.

glucono delta-lactone (GDL)—a substance that transforms into gluconic acid (an acid created by the oxidation of glucose) in water.

gluten—a combination of the protein glutenin and the protein gliadin found in cereals, notably wheat, that gives dough its characteristic cohesiveness.

glycine—a mildly sweet-tasting amino acid.

glycogen—a polysaccharide composed of a large number of glucose molecules. It is the main form in which animals store carbohydrates in tissue and is thus sometimes called the "starch equivalent" for animal cells.

grooming—a procedure in espresso coffee preparation in which excess grounds placed in the portafilter are removed and the surface of the remaining grounds is leveled.

gum—a **polysaccharide** derived from plants that swells when wet and can thicken or gel depending on various factors.

hard water—water containing particular dissolved **ions**, such as magnesium or calcium salts.

hazard ratio—a statistical estimate of relative risk.

heads—the second condensate material produced in a distillation process.

heat flux—the amount of heat that flows across a particular area in a particular amount of time.

heat labile—subject to alteration by heat.

heat of fusion—the amount of energy that is needed for one mole of a solid to melt into a liquid. Also known as the latent heat of fusion.

heat of sublimation—the amount of energy that is needed for one mole of a solid to turn into a vapor.

heat of vaporization—see **latent heat of vaporization**.

heat transfer coefficient—a measurement of how much heat is transferred between media or systems.

heat—a transfer of energy due to a difference in temperature.

hemoglobin—an iron-containing protein pigment in the red blood cells of vertebrates.

heterocyclic amine (HCA)—an organic compound consisting of more than one kind of atom. It is created by replacing at least one hydrogen atom in ammonia with an alkyl group. These compounds are believed by some to exacerbate cancer.

high-density lipoprotein (HDL) cholesterol—a combination of a protein and a lipid found in blood. It is sometimes called "good cholesterol", because research indicates it may be beneficial for cardiovascular health.

high-pressure homogenizer—a device used to create an extremely fine emulsion by applying very high amounts of pressure.

high-shear mixing—a process by which an emulsion is created using a large amount of shear force.

horn—a cylindrical ultrasonic homogenizer component, usually made of solid titanium, that transmits ultrasonic sound waves to a liquid to cause cavitation and thus homogenization to occur.

horsepower—a unit of power equal to 746 W (2,544 BTU/h).

hot-boning—the process of butchering and sometimes processing the meat of a slaughtered animal before its body has progressed to rigor. Hot-boned meat has a higher moisture-holding capacity and forms more stable meat emulsions, which renders it useful for sausage making.

humectant—a substance that causes a material to retain moisture.

humidity-controlled mode—see combination mode.

hydrated—having incorporated water.

hydration—the process of incorporating water or its elements, such as the combination of molecular water with the components of a molecule.

hydrocolloid—a substance that forms a **colloidal suspension** when dispersed and hydrated in water; hydrocolloids are usually starches or plant gums and are used to thicken or gel water-based food liquids.

hydrogen bond—a bond involving the attraction of one hydrogen atom to two atoms existing in one or more molecules. It is a very important phenomenon for water.

hydrolysis—the decomposition or alteration of a chemical substance by water.

hydrophilic—able to attract or absorb water.

hydrophilic-lipophilic balance (HLB)—in a surfactant **emulsifier**, it is a numeric measure of the mass of the hydrophobic to hydrophilic parts of the molecule, normalized to lie in the range of 1 to 20. The HLB gives a rough indication of how the surfactant functions in an emulsion.

hydrophobic—repelled by water or not possessing an affinity for it.

hygroscopic—able to attract and retain water.

hyperosmia—an ability to smell that is greater than normal.

hyposmia—impairment of the ability to smell.

hypothesis—an assumption made on a tentative basis to test its validity.

ice-restructuring compound—a chemical compound that affects the structure and processes of ice, such as an antifreeze protein.

ID50—the number of infectious organisms needed to infect 50% of study subjects. Also see **infectious dose**.

ike jime—a Japanese fish-slaughtering technique in which the spinal cord is severed to improve the quality of the flesh.

immediate service—a method of sous vide food preparation in which food is served immediately after cooking rather than being refrigerated or frozen for later use.

immersion circulator—a device that, when attached to a vessel that contains water, heats and circulates the water to create a circulating bath.

immiscible—incapable of being blended into a homogeneous solution.

inactivation—the cessation of the capacity to engage in a particular biological activity, such as a virus's ability to infect a cell.

index of refraction—the ratio of the velocity of light in one medium to its velocity in another as it passes between the two.

individual quick freezing—a blast freezing or fluidized-bed freezing process in which each individual piece of a food is frozen as a separate unit.

infectious dose—the average number of infectious organisms that must be present in a host to establish a self-sustaining infection.

infusion—removal of a material from a substance by steeping it in a solvent, such as brewing tea by extracting flavor from the tea with hot water.

insoluble—the inability of a substance to dissolve in another substance.

insulator—a substance that is a poor medium for conduction.

integral—in math, the cumulative sum of a function over a given interval or region.

intensity—the amount of a quality or condition; a measure of the effect of an agent expressed as the magnitude of force or energy per unit.

intermediate fiber—a type of fast-twitch muscle fiber that has greater stamina than standard fast-twitch fibers because it can utilize oxygen for sustained aerobic activity.

intermediate-density lipoprotein (IDL) cholesterol—a combination of a protein and a lipid found in blood that has a density between that of HDL and LDL.

internal energy—the total energy of a system that exists in a form other than the potential and kinetic energy of the system as a whole. Internal energy includes the kinetic energy of constituent molecules in motion within the system, potential energy stored in chemical bonds, energy from chemical interactions, and other forms of energy inside the system.

intracellular fluid—the fluid within a cell.

invasive infection—an infection in which pathogens invade human tissue.

ion—an atom, molecule, electron, or proton that has a positive or negative electric charge from losing or gaining one or more electrons.

ion-exchange filter—a resin that can exchange ions, such as the replacement of calcium ions with sodium ions, to create deionized water.

ionic compound—a substance composed of oppositely charged ions, often metal ions and nonmetal ions, held together by electrical attraction. Table salt, composed of ions of the metal sodium and the nonmetal chlorine, is one example.

irreversible change—an alteration that cannot be undone.

joule—a metric energy unit in the MKS (meter-kilogram-second) system. It is the work produced by one newton (a unit based on the force needed to accelerate 1 kg by 1 m/s^2) on a point that is displaced by 1 m in the force's direction.

jus—liquid that seeps out of meat during cooking. Also known as juice.

ketosis—a condition in which the amount of ketones (organic compounds in which two carbon atoms are bound to a carbonyl group) increases in the body because of a disruption in the processing of carbohydrates.

kilowatt—a unit of power that is the equivalent of 1,000 watts.

kuru—a degenerative brain disease of humans (known only in New Guinea) in which the brain tissue becomes porous, leading to dementia, loss of muscle control, and death. It is caused by prions and was spread early in the 20th century by ritualistic cannibalism.

latent heat of vaporization—the amount of energy that is needed to evaporate liquid into a gas.

LD50—the number of infectious organisms needed to kill 50% of study subjects. Also see **lethal dose**.

Leidenfrost effect—an effect that occurs when liquid is in contact with a surface hot enough that a cushion of vapor holds the liquid off the surface.

lethal dose (LD)—the number of infectious organisms needed to kill an individual.

lignin—a substance in wood that reinforces cell walls for durability. It is indigestible by most animals.

lipid—the technical term for the fats and oils that form one of the basic building blocks of living cells.

lipophilic—attracting or having an affinity for lipids (fats and oils).

lipoprotein—a molecule in which a protein and a lipid are combined.

listeriosis—an disease caused by the bacterium Listeria monocytogenes.

low-density lipoprotein (LDL) cholesterol—a protein-lipid combination found in the blood. It is sometimes called "bad cholesterol" because some studies implicate it as a risk factor for cardiovascular disease.

low-temperature steam mode—a mode in a water-vapor oven or a combi oven in which steam heated below water's boiling point is used to cook food.

lungo—an espresso coffee that is made by continuing to extract coffee for a longer period of time. It is usually more bitter than espresso brewed for a normal time period.

lyophilization—see **freeze-drying**.

magnetic stirrer bar—a bar that is made to spin magnetically within a container of liquid to stir it.

Maillard reaction—a chemical reaction between sugar and amino acid that creates a brown color and particular flavor compounds in certain foods, including meat and bread. It is one of the primary causes of browning in foods.

melanoidin pigment—a pigment created by protein or amino acid.

meta-analysis—a statistical analysis of several studies with similar hypotheses done to determine the significance of their results taken together as a whole.

metastable—a substance that is only slightly stable and thus easily changes during processes such as oxidation.

metmyoglobin—a reddish-brown pigment formed from the oxidation of myoglobin. It causes meat to appear old or not fresh.

microaerophilic—requiring only a little oxygen to function, as is the case for certain microorganisms.

microfoam—in espresso coffee, a desirable foam that is made of bubbles too small to be perceived.

microorganism—an organism whose size is microscopic or smaller.

Microoxygenation (MOX)—a wine-making process in which small, precise amounts of oxygen are injected into fermenting wine to control its rate of oxidation.

microporous filtration—a method of water purification in which unwanted substances are removed by moving the water through extremely small openings.

microwave—an electromagnetic wave with a wavelength ranging from about 0.3–30 cm / 0.1–11.8 in and a frequency of 1–100 GHz.

middle run—the third condensate material produced in a distillation process. It occurs in between the heads and the tails.

Mie scattering—the process of scattering light by particles that do not conduct a direct electric current.

mirepoix—a combination of onions, carrots, and celery (although other ingredients can be included) that flavors many dishes in French cooking, notably stocks.

miscible—the ability of two or more substances to blend into a homogenous solution.

molded spherification—see **cryospherification**.

monounsaturated fat—a fat in which each fatty acid molecule has only one double or triple bond.

motile—able to move.

muscle fiber—a cell that is capable of contracting and that forms muscle.

myocomma—a sheath of connective tissue that separates muscle segments in fish.

myofibril—a small, contracting fiber within a muscle cell.

myoglobin—a protein pigment in muscles that contains iron; similar to hemoglobin.

myoseptum—a septum that acts as a **myocomma**.

myosin—a muscle protein that combines with actin to form actomyosin (a complex involved in muscle contraction). Myosin constitutes half of all the protein in muscle.

myotome—a group of muscles that are connected to the same spinal nerve.

nanofiltration—a filtration method in which pressure causes a substance to pass through a semipermeable membrane with pores sized for the passage of molecules ranging up to a diameter of a few nanometers or less.

natural convection—heat transfer that occurs within a substance such as a fluid, due only to fluid movement caused by density changes arising from heat.

nematode—an unsegmented, often parasitic worm of the class Nematoda.

neural arch—an arch of cartilage or bone on the back side of a vertebra that, with other neural arches, forms the area that houses the spinal cord.

nonclimacteric—fruit which do not ripen after being picked and are not affected by ethylene gas.

noninvasive infectious bacteria—bacteria that infect the surface area of the body but do not penetrate human tissue.

nonionic compound—a compound made of molecules that are not bonded by ionic forces and are instead joined by a different sort of chemical bond, such as a covalent bond.

nonpolar solvent—a solvent whose molecules are not dipoles. Oils are examples of common nonpolar solvents.

normale—the standard concentration of coffee beans and amount of fluid used to make an espresso coffee in Italy.

norovirus—an RNA-based infectious virus that causes gastroenteritis.

NSEW technique—in espresso making, a method of grooming that involves sweeping ones finger from the center of the portafilter in the four directions (North, South, East, West) to level the coffee grounds.

nucleated boiling—boiling due to heating of the vessel that holds a liquid during which the resulting bubbles of steam rise to the surface.

nucleation site—the place where water being heated in a vessel forms vapor bubbles.

nutritional epidemiology—the study of the incidence and distribution of disease in a population and of the control of that disease in relation to nutrition.

O/W—an **emulsion** in which oil is distributed in water. Oil is the dispersed phase, water is the continuous phase.

observation bias—a systematic error in a study that arises from the study method. Examples include faulty measurement or the misclassification of subjects.

odds ratio—the ratio of the likelihood (probability) of an event occurring to its likelihood of not occurring.

oleoresin—a material consisting of resin (a class of organic material that is wholly or partly solid and that does not possess a definite melting point) mixed with essential oil that is extracted from a plant via a nonpolar solvent. Also known as a concrete.

oocyst—an encased cell from which microorganisms develop.

osmosis—the passage of a solvent from a solution that has a lower concentration of a dissolved substance to one with a higher concentration of that substance. This passage occurs through a semipermeable membrane (one that can be penetrated by some molecules but not others).

osmotic pressure—the pressure applied by a solution on a membrane through which the solution can pass. This pressure separates the solution from the solvent, thereby causing osmosis to occur. Alternately, the pressure needed to prevent osmosis.

Ostwald ripening—one of the failure modes of an emulsion, in which droplets of the dispersed phase grow by absorbing material dissolved in the continuous phase. This preferentially causes large droplets to grow larger, and small droplets to become smaller.

oxidation—a chemical reaction in which oxygen is chemically bound to a compound.

oxymyoglobin—a pigment formed by combining oxygen and **myoglobin**. It gives red meat its fresh, pink, or red appearance.

p value—a measure of the statistical significance of a difference or change found in a scientific study. The higher the p value, the more likely it is that the difference or change is due to chance. Study results with lower p values are generally considered more reliable; 0.05 is usually considered the maximum threshold for statistical significance.

Pacojet—a device that grinds frozen food while also blowing high-pressure air jets at it to reduce the food to extremely fine particles in order to puree, blend, or emulsify it.

pacotize—to use a Pacojet to process food to puree, blend, or emulsify it.

pale soft exudate (PSE)—a property of meat, especially pork, in which stress before slaughter results in a rapid decline in muscle pH. This decreased pH, combined with residual body heat, causes the meat's muscle protein to break down, which makes it mushy

and pale and causes it to exude moisture.

papain—an enzyme found in papaya that breaks down protein; used to tenderize meat.

partial pressure—the pressure that a single gas in a mixture would exert if present alone.

pasteurization—heating a substance to a certain temperature for a certain amount of time to kill a prescribed fraction of any harmful organisms that may be in it.

pathogen—a disease-causing agent, typically a bacteria, protist, or virus.

pathogenic—causing disease.

pellicle—a thin film or membrane. In smoking, it results when compounds in smoke's gaseous phase react with protein on the surface of meat or seafood.

peptide—a fragment of a protein made up of at least two amino acids bound by their respective carbon and nitrogen atoms.

percolation—the movement of fluid through a porous material.

perimysium—a layer of connective tissue that encases bundles of muscle fibers that define the grain of meat.

phase change—a change from one state (solid, liquid, or gas) to another without a change in chemical composition.

phase diagram—a graph charting the temperature and pressure that result when a particular substance changes phase (such as from a liquid to a gas or solid).

phenol—a soluble, crystalline, acidic compound present in coal and wood. Phenols formed from burning lignin in wood are responsible for many of the characteristic aromas of smoked food.

pheophytin—an olive-brown pigment that develops from the transformation of chlorophyll.

pin-and-disc mill—a device used to break up hard, dry foods by cutting and pulverizing them.

plasmid—DNA that operates outside chromosomes and that is found in certain bacteria.

plasmolysis—the shrinking of the protein in the body of a cell away from the cell wall when water leaves a cell by osmosis.

plate freezer—a device used to quickly freeze food by surrounding it with two chilled plates.

polar solvent—a solvent composed of molecules that are **dipoles**. Water is a polar solvent.

polyphenol oxidase (PPO)—a copper-containing enzyme that converts a phenol to a quinone via oxidation. The enzyme largely responsible for the discoloration of bruised, cut, or otherwise damaged plant foods.

polysaccharide—a carbohydrate that can be changed by water into at least two molecules of the simple sugar saccharide.

polyunsaturated fat—a fat in which each fatty acid molecule has more than one double or triple bond.

portafilter—the portable filter basket of an espresso machine.

precipitate—the act of a solid separating from a liquid, or the solid resulting from such a separation.

precision—the fineness with which an instrument can discriminate in its measurements among slightly different values. Note that this is not the same as **accuracy**.

preinfusion—in certain espresso machines, a stage in espresso making during which low-pressure water fills the portafilter before high-pressure water is applied to extract the grounds. Preinfusion is generally done to promote consistency.

pressure filter—a mechanism used for vacuum filtration in which high pressure is created on the side of the filter on which the mixture of liquid and solid material is placed.

primal cut—one of the main cuts of an animal carcass that consists of muscles from particular areas.

primary emulsion—the dispersal of one substance into another during the first stage in the formation of an emulsion.

prion—an infectious protein particle that lacks nucleic acid and is responsible for several animal and human diseases characterized by degeneration of nerve tissue, including CJD and BSE.

proportional-integral-derivative (PID) controller—a device that controls processes by taking three parameters into account: the proportional value (the ratio between two quantities), the **integral** value, and the **derivative** value.

prospective study—a study in which subjects who share a particular characteristic are followed up over time.

protein folding—the change in shape of a protein from linear form into the complicated three-dimensional shape the protein requires to function.

protein—any of a large class of complex, amino acid-containing molecules. Proteins are essential parts of all livings cells and of the diets of all animals. Proteins are a primary constituent of animal tissue, but are also found in plants.

proteolytic—causing protein molecules to break down into **peptides**.

protists—a group of simple, usually single-celled microorganisms.

publication bias—the inclination of researchers, editors, or publishers to publish certain results and not publish others due, for example, to what they think is important, controversial, or noteworthy. This can be important if published results are unrepresentative of all results obtained.

pyrolysis—the process by which heat causes complex molecules to break apart into simpler compounds.

quorum sensing—a phenomenon exhibited by certain bacteria, in which small molecules secreted by that bacteria can be detected by bacteria of the same type, allowing the bacteria to detect its population density and eliciting a particular reaction.

radiant heat—see **radiative heating**.

radiation—energy that flows through a medium or space via electromagnetic waves. In cooking, the radiation is typically infrared light.

radiative heating—heating by means of energy that flows through a medium or space via electromagnetic waves.

randomized trial—a statistical study in which subjects are randomly assigned to different groups.

recall bias—a systematic error in a statistical study that arises because the recollection of study subjects varies in accuracy and thoroughness.

reflectivity—the ratio of the part of the energy in a wave that falls on a surface to the part that reflects from the surface.

relative humidity—the ratio of the mass of water vapor in air to the maximum mass of water vapor that the air could hold at that temperature.

relative risk—the ratio that divides the likelihood of an event occurring to those exposed to a factor by its likelihood in those not exposed to the same factor.

resting—a cooking technique in which food that has been heated is allowed to sit for a period of time. Resting allows temperature and distribution of water (juices) to equilibrate.

retort bag—a plastic bag capable of withstanding the high temperature and pressure that is used in sous vide canning.

reverse osmosis—a process in which pressure is used to push water through a membrane to purify or desalinate it.

rheometer—an instrument used to measure the flow of a substance.

ribose—a pentose (a sugar with five carbon atoms that doesn't decompose into simple sugars in water) found in several nucleotides, including RNA. It is responsible for flavor in some stocks and meat jus.

ristretto—an espresso shot that is brewed for a shorter time period. Typically it is half the volume of a **normale**.

RNA (ribonucleic acid)—nucleic acids involved in the formation of protein in cells.

roller mill—a device used to break up hard, dry foods by cutting and compressing them.

rotary evaporator—a distillation device that uses rotation to make a thin film of liquid to speed evaporation. Typically they also use vacuum to distill at low temperatures.

rotor-stator homogenizer—a device used to create an emulsion or puree solids suspended in liquid by spinning a blade that forces liquid through a small opening, thus breaking up particles in it.

rotor—the rotating component of a device, such as the rotating blades used in a rotor-stator homogenizer.

salinity—salt concentration.

sampling error—an error that occurs in a statistical study because of a random discrepancy between the sample studied and the larger population that the sample is meant to represent.

sarcomere—a muscle segment composed of **myofibrils** that forms alternately light and dark bands.

saturated fat—a fat in which each fatty acid molecule has no double or triple bonds.

saturated solution—a solution in which a particular substance has been dissolved to such an extent that no more of that substance can be dissolved in it.

saturated—a condition in which a substance (such as a molecule or a liquid) has combined with another substance as much as possible.

saturation vapor pressure—the heat-related vapor pressure that causes a substance's vapor to exist in equilibrium with the solid or liquid phase of that substance at a particular temperature. Also see **equilibrium vapor pressure**.

scientific name—a name used to classify an organism. It consists of two Latin words representing the organism's species and genus.

seam cutting—a butchery technique in which the muscles of primal cuts are separated into individual muscles rather than simply being cut into steaks or roasts.

seasoning—material added to food to add a desirable taste and/or odor.

secondary emulsion—the second stage of emulsification during which the emulsion is beaten to more finely disperse one substance into another.

sedimentation—the settling of material after it has been deposited in a liquid.

selection bias—a systemic error in a study that occurs because of the way in which researchers select subjects.

septum—a membrane that divides two hollow spaces within a portion of a body.

sequestrant—a chemical used to remove (sequester) ions from a solution. Most often used to remove calcium and magnesium ions to allow **hydration** or to prevent premature gelling of hydrocolloid gums.

serotype or serovar—a grouping of microorganisms (such as bacteria) based on a shared number of antigens (substances on a microorganism's surface that provoke an immune response in another organism).

set foam—a foam that has been stabilized into a gel or a solid so that it will not dissipate.

settling period—the first stages of baking or drying in which the surface of food rapidly warms to the **wet-bulb temperature** determined by the surrounding conditions.

shear force—a force that displaces one part of a body from a part directly attached to it in a parallel direction.

shear-thinning fluid—a reduced-viscosity fluid that does not follow Newtonian laws.

silverskin—see **epimysium**.

single- or double-disc mill—a device used for breaking up hard, dry foods by cutting them with one or two discs.

slug-and-column boiling—a boiling stage in liquid that has reached a temperature above its boiling point. In this stage, rising bubbles of steam appear because of their speed to emanate as solid columns from the bottom of the heated container.

small dense LDL (sdLDL) cholesterol—a protein-lipid combination found in blood. It is a subset of LDL and is considered a risk factor for cardiovascular disease.

sodium hexametaphosphate—a salt that is often used as a sequestrant to prevent a hydrocolloid from thickening or gelling.

sodium tripolyphosphate—a salt that is used in many food applications, including brining and curing meat, preparing forcemeats, and restructuring cheese.

solidus—the boundary on a phase diagram separating solid material from liquid or gas.

solubility limit—the point at which no more of a substance can be dissolved into another substance.

solubility—how much of a substance can fully dissolve into another substance.

soluble concentration—the ratio of the mass of a solute to the mass of the solvent in which it is dissolved.

solubles yield—see extraction percentage.

solute—a substance that is dissolved into another substance.

solution—a mixture of at least two components that are distributed in a uniform fashion to form a homogenous whole.

solvent—a substance in which another substance can be dissolved.

sous vide canning—a method of preserving food in which the food is sealed in an airtight retort bag instead of a jar or can and sterilized at high temperature and pressure.

sous vide—a cooking technique in which food is usually (but not necessarily) vacuum sealed, then cooked at accurately controlled temperatures.

species—structurally similar organisms that form an interbreeding population.

specific heat capacity—the amount of heat needed to raise a substance's temperature by one degree per unit of mass.

spherification—a process in which fluid beads or spheres are encased in a gel such as alginate, gellan, or pectin.

spinal ganglia—a mass of sensory nerve tissue at each nerve in the spine's dorsal root, which connects the brain to the spine on the back-facing side.

spoilage bacteria—bacteria associated with food deterioration.

sporadic Creutzfeldt-Jakob disease (sCJD)—a form of Creutzfeldt-Jacob disease in which the **prions** that cause the disease seem to have formed spontaneously.

stage—an internship completed by prospective chefs.

stagier—a prospective chef who is completing a *stage*.

statin—a drug that inhibits cholesterol synthesis and promotes receptors that bind to **LDL cholesterol**, thus reducing levels of LDL cholesterol and increasing levels of **HDL cholesterol**. Statins have been proven effective in reducing cardiovascular disease in men.

statistical power—the probability that an observed variation in a statistical study is due to a specific procedure and not just chance.

stator—the portion of a device that a rotor spins in or in relation to, such as the stationary segment of the rotor assembly in a **rotor-stator homogenizer**.

steam mode—a combi oven mode in which steam heated to water's exact boiling point is used to cook food.

steam—an invisible vapor or gas phase of water. Steam is often confused with the visible fog of condensed moisture droplets.

steric hindrance or **steric resistance**—chemical or physical effects caused by the shape or orientation of molecules.

sterilization—killing or inactivating all of the microorganisms in a substance.

stirred bath—see circulating bath.

Stockfleth's method—a method of grooming coffee for an espresso shot that utilizes the web between one's forefinger and thumb to smooth out excess grounds.

stretching—in preparing steamed milk for espresso, the initial process in which a steam wand held under the milk's surface creates small bubbles.

sublimation—the process in which a material changes from a solid state to a gas one without changing to a liquid state first.

subspecies—a group of organisms within a species that is genetically distinct from other groups in that species.

sulfur dioxide—a colorless gas used in wine-making to kill harmful organisms.

supercooled—cooled below the point at which a substance should change phase (such as a liquid freezing into a solid), without the occurrence of that change.

supercritical fluid—a fluid that has reached a temperature and pressure at which it acts like both a liquid and a gas, which is called the supercritical state.

superheated gas—a gas derived from a liquid that has been heated to a temperature above the boiling point of that liquid.

supersaturated solution—a solution that contains more of a solute than can be dissolved in its solvent.

surface tension—a force naturally exerted on a liquid's surface that minimizes its surface area, thus causing it to form into roughly spherical droplets.

surfactant—a soluble compound that reduces the surface tension of its solvent liquid. A surfactant can also be used to reduce the surface tension between two liquids or between a liquid and a solid, or a liquid and a gas. The name is derived from the phrase surface-active agent.

syneresis—a process in which liquid separates and weeps from a gel when the gel is damaged or shrinks.

synergy—a process that occurs because of the effect of at least two substances when combined and that results in an effect that is greater than the sum of the effects of the separate substances.

tails—the final set of condensate materials produced in a **distillation** process.

tamp—in preparing espresso coffee, the act of firmly packing coffee grounds in a portafilter so that the application of pressurized water will result in an even extraction.

tastant—a substance that stimulates the taste buds, creating a sense of taste.

TCA (2,4,6-trichloroanisole)—a compound associated with corked wine, producing a moldy taste and odor in the wine.

temperature—the value of "heat" or "coldness" that determines the direction in which heat flows between contacting objects as measured on a relative scale, such as Celsius or Fahrenheit.

terroir—a flavor characteristic associated with a particular area, such as with wine.

tetradecahedron—a solid body consisting of 14 flat sides.

tetrasodium pyrophosphate—a white powder used as a coagulant, an emulsifier, and a **sequestrant**.

texturing—the process of steaming milk during coffee preparation.

themo-irreversible gel—a gel that remains in a gel state regardless of temperature.

thermal conductivity—the ability of a substance to transfer heat through the exchange of energy between particles.

thermal death curve—a curve depicting the range of temperatures required and the amount of time those temperatures need to be applied to kill bacteria.

thermal inactivation curve—a curve depicting the range of temperatures required and the amount of time those temperatures need to be applied to stop a specific biological activity, such as viral infection of a cell.

thermodynamic—relating to the mechanics of heat.

thermo-irreversible—a substance that, once transformed from another state (such as

from a liquid to a solid), cannot return to its previous state by the application of heat.

thermo-reversible gel—a gel that returns to a liquid state when heated to its melting point and does not return to a gel when cooled.

thermo-reversible—a substance that, once transformed from another state (such as from a liquid to a solid), can return to its previous state by the application of heat.

thermostat—a device that measures and regulates temperature.

tincture—a solution of a material in alcohol, water and alcohol, or ether and alcohol.

torr—a unit of pressure used most often in vacuum systems; 1 torr equals approximately 1.3 millibar or one millimeter of mercury.

total dissolved solids (TDS)—the amount of a solid substance that has been dissolved in a liquid (such as the amount of extracted compounds in coffee).

trans fat—a fat that contains trans fatty acids (unsaturated fatty acids that have been associated with an increase of cholesterol in the blood).

transglutaminase—a family of natural enzymes that causes amino acids in proteins to cross-link or bond. This can be used to coagulate a protein containing liquid into a gel, strengthen a protein-based gel, or "glue" meat or other proteins together. Activa is a popular brand name.

trichinellosis—a foodborne disease caused by the trichina parasite. Also called trichinosis.

triglyceride—a lipid that consists of fatty acid and an alcohol called glycerol.

trimethylamine oxide (TMAO)—a compound that creates an unpleasant smell in aging fish carcasses by reacting with fatty acids.

triple point—the temperature and pressure necessary for a substance to exist in three phases (such as solid, gas, and liquid) acting in equilibrium.

Tyndall effect—light scattering by a colloidal suspension of particles in a fluid. It is related to Mie scattering and Rayleigh scattering.

ultrasonic homogenizer—a device that causes cavitation in liquids by creating high-frequency vibrations in the liquid. The collapse of cavitation bubbles can reduce the size of dispersed particles (such as oil droplets) to form a stable suspension or **emulsion**.

ultraviolet light—light whose wavelength is longer than that of x-rays and shorter than that of light visible to humans.

unsaturated fat—a fat with fatty acid molecules that have two or more double or triple bonds. It is typically found in vegetable oils. Unsaturated fats are usually liquid at room temperature.

urea—a compound formed by protein decomposition; found in the urine of humans, mammals, and certain other animals.

vacuole—in plant cells, a cavity filled with air and water.

vacuum evaporation—a method of removing excess water from a material, by evaporating it using low pressure (i.e., a partial vacuum).

vacuum filtration—a process for filtering liquids using a vacuum to help force the liquid through the filter.

vacuum inflation—a method of creating foam by subjecting a liquid to low pressure, causing gas bubbles in it to expand, and causing gas dissolved in the liquid to come out of solution.

vacuum reduction—a method concentrating a liquid food, by evaporating water from it using low pressure (a partial vacuum). This lowers the boiling point and allows evaporation to occur at lower temperatures.

vacuum—a space in which little to no matter exists (ideally none) and in which gases do not interfere with processes because the pressure is far lower than typical atmospheric pressure. In practice, all attainable vacuums are only partial, having low gas pressure.

vapor pressure—the pressure created by a vapor that exists in equilibrium with a solid or a liquid.

vaporization—changing a substance from a liquid or solid state to a gas.

variant Creutzfeldt-Jakob disease (vCJD)—a form of Creutzfeldt-Jacob disease caused by eating prion-infected beef products.

very-low-density lipoprotein (VLDL)—a molecule in which a protein and a lipid are combined, which is found in blood. VLDLs are implicated as potential being the most dangerous form of **LDL** as a risk factor for cardiovascular disease.

vicinal water—water whose molecules are attached to particle surfaces via hydrogen bonding. This type of water in food evaporates only at temperatures that are higher than usual.

virion—a virus particle.

viscometer—a device used to measure a substance's viscosity.

viscosity—the ability of a gas or liquid to resist flowing when shear force is applied to it.

W/O—an emulsion in which water is distributed as the dispersed phase in a continuous phase of oil.

water activity—a measurement of the amount of free water that is not bound to other molecules.

water-vapor oven—an oven that uses heated water vapor to cook.

wavelength—the distance between two points in a wave along the line of the direction in which the wave is advancing.

Weiss Distribution Technique (WDT)—in espresso making, a method of grooming that involves adding coffee to the portafilter with a funnel, then stirring the grounds to prevent clumping.

wet-bulb temperature—the temperature measured by a thermometer with a wet sensor. It is never higher than the **dry-bulb temperature**. Wet-bulb and dry-bulb temperatures are equal when the relative humidity is 100%, otherwise wet-bulb is lower.

wet-curing—see **curing**.

wet-grinding—the process of grinding material into smaller pieces in a fluid.

whipping siphon—a device used to create foam in which particles of pressurized gas inserted into a liquid-filled metal tube expand into bubbles in the liquid as they leave the tube.

xanthophyll—a yellow carotenoid pigment found in certain flowers, fruits, and plant leaves.

yeast—a single cell fungus used in fermenting wine, and in creating the gas bubbles that cause bread to rise.

SOURCES OF EQUIPMENT AND INGREDIENTS

Equipment

Purveyor	Address	Phone	Website	Products
A & D Engineering	1756 Automation Pkwy. San Jose, CA 95131	408-263-5333	andweighing.com	scales
Accutemp Products, Inc.	8415 N. Clinton Park Fort Wayne, IN 46825	800-210-5907	accutemp.net	Accu-Steam griddles
Aerolatte	2 Codicote Rd. Welwyn AL6 9NB United Kingdom	(+44) 845 872 4954	aerolatte.com	Aerolattes
Avestin, Inc.	2450 Don Reid Dr. Ottawa, Ontario K1H1E1 Canada	888-AVESTIN	avestin.com	high-pressure homogenizers
Benriner Co.	741-0062 3-7-3, Iwakuni City, Yamaguchi Japan	(+81) 0827 43 4033	benriner.co.jp	Japanese mandolins
Berkel, Inc.	701 S Ridge Ave. Troy, OH 45374	800-348-0251	berkelequipment.com	slicers
Biro Manufacturing, Co.	1114 W. Main St. Marblehead, OH 43440	419-798-4451	birosaw.com	meat grinders
Branson Ultrasonic Corp.	41 Eagle Rd. Danbury, CT 06813	203-796-2298	bransoncleaning.com	ultrasonic baths
Büchi Corp.	19 Lukens Dr., Suite 400 New Castle, DE 19720	877-MYBUCHI	buchi.com	rotary evaporators
Buon Vino Mfg. Co.	PO Box 26003 365 Franklin Blvd. Ontario N1R 8E8 Canada		buonvino.com	wine filters
Cambro	5801 Skylab Rd. Huntington Beach, CA 92647	800-833-3003	cool.cambro.com	food storage containers
Carpigiani Corp of N. America	3760 Industrial Dr. Winston-Salem, NC 27105	336-661-9893	www.carpigiani.com	ice cream machines
Champion Juicer/ Plastaket Mfg. Co.	6220 E. Highway 12 Lodi, CA 95240	866-935-8423	championjuicer.com	juicers
Comeau Technique, Ltd.	440 Aime-Vincent Vaudreuil-Dorion Québec J7V 5V5 Canada	800-361-2553	comeau.ca	aspirators
Corning	Tower 2, 4th floor 900 Chelmsford St. Lowell, MA 01851	800-492-1110	corning.com	hot plates, Pyrex beakers
CSC Scientific	2799-C Merrilee Dr. Fairfax, VA 22031	800-621-4778	cscscientific.com	viscometers
Cuisinart	150 Milford Rd. East Winsor, NJ 08520	800-726-0190	cuisinart.com	food processors
Fisher Scientific Worldwide	2000 Park Lane Dr. Pittsburgh, PA 15275	412-490-8300	fishersci.com	rotor-stator homogenizers, water baths
Fluke Corp.	6920 Seaway Blvd. Everett, WA 98203	425-347-6100	us.fluke.com	thermometers

Equipment, continued

Purveyor	Address	Phone	Website	Products
Genevac, Inc.	815 Route 208 Gardiner, NY 12525	845-267-2211	genevac.com	Genevac rocket distillers
Hamilton Beach Brands, Inc.	360 Page Rd. Washington, NC 27899	800-851-8900	hamiltonbeach.com	milk shake blenders
Hanna Instruments, Inc.	584 Park E. Dr. Woonsocket, RI 02895	800-426-6287	hannainst.com	refractometers, pH meters
Henkelman BV	PO Box 2117 5202 CC's-Hertogenbosch Netherlands	(+31) 73 621 36 71	henkelman.com	vacuum sealers
Hi-Tech Vacuum, Inc.	1445A, RR5 Saint-Cyrille-de-Wendouer Québec J1Z 1S5 Canada	819-397-4888	hitechvacuum.com	vacuum sealers
Hobart Corp.	701 S Ridge Ave. Troy, OH 45374	888-HOBART	hobartcorp.com	tumble briners
Hoshizaki America, Inc.	618 Hwy. 74 S Peachtree City, GA 30269	800-438-6087	hoshizakiamerica.com	ice machines
Hualian Packaging Machines	6 Chanyeyuan Rd. 325028 Wenzhou, China	(+86) 57 78 86 27 766	hualianpackagingmachines.com	strip sealers
iSi North America, Inc.	175 Route 46 W Fairfield, NJ 07004	973-227-2426	isinorthamerica.com	siphons
Iwatani Group	2050 Center Ave., Suite 425 Fort Lee, NJ 07024	201-585-2442	iwatani.com	induction burners
JB Prince	36 E. 31st St. New York, NY 10016	800-473-0577	jbprince.com	books, kitchen utensils
Julabo	Eisenbahn Strasse 45 77960 Seelbach Germany	(+49) 7823 510	julabo.de	cooling baths
Koch	1414 West 29th Street Kansas City, MO 64108-3604 USA	816-753-2150	kochequipment.com	chamber-style vacuum sealers
Kuhn Rikon	CH-8486 Rikon, Switzerland	(+41) 52 396 01 01	kuhnrikon.ch	pressure cookers
Labline Scientific Instruments	C/108 Maruti Darshan Hanuman Chowk L.T. Road, Mulund (East) Mumbai 400 081 Maharashtra, India	(+91) 22 216 33671	labline.in	water baths
Lenox	301 Chestnut St. E. Longmeadow, MA 01028	413-525-3961	lenoxtools.com	MAPP gas torches
LISS America	2060 O'Neil Rd. Macedon, NY 14502	315-986-7685	liss-america.com	nitrous and carbon dioxide chargers
Mettler Toledo, Inc.	1900 Polaris Parkway Columbus, OH 43240	800-METTLER	us.mt.com	scales
Microplane	614 S.R. 247 Russelville, AR 72802	800-555-2767	us.microplane.com	Microplanes
Moschetti, Inc.	11 6th St. Vallejo, CA 94590	800-556-4414	moschetti.com	pasta machines

Equipment, continued

Purveyor	Address	Phone	Website	Products
Multivac	11021 North Pomona Ave. Kansas City, MO 64153	816-891-0555	multivac.com	chamber-style vacuum sealers
Omni	935-C Cobb Place Blvd. NW Kennesaw, GA 30144	770-421-0058	omni-inc.com	rotor stator homogenizer
Pacojet AG	Bundestrasse 7 CH-6300 Zug Switzerland	(+41) 41 710 2522	pacojet.com	Pacojet
PicoTech	James House Marlborough Road Colmworth Business Park Eaton Socon St Neots, Cambridgeshire PE19 8YP United Kingdom	(+44) 1480 396 395	picotech.com	temperature loggers
PolyScience	6600 West Touhy Ave. Niles, IL 60714	800-229-7569	polyscience.com	circulators; Anti-Griddle
Rational Ovens / Akno Ltd.	895 American Lane. Schaumburg, IL 60173-4570	866-891-3528	rationalusa.com	combi ovens
Sanplatec Corp.	No. 1-3, 2-Chome Doshini, Kita-ku Osaka City 530-0035 Japan	(+81) 816 63 53 5141	www.sanplatec.co.jp	Drykeeper environmental chamber
Sartorius AG	5 Orville Dr. Bohemia, NY 11716	800-645-3108	sartorius.com	scales
Shanghai Shenyin Machine Factory	Room 1703-04 Building B Long 48 Jiaotong West Rd. Shanghai,China	(+86) 21 56 080 777	www.shenyin.com	colloidal mills
SP Industries / Virtis	935 Mearns Rd. Warminster, PA 18974	800-523-2327	spscientific.com	freeze dryers
Sunpentown/ Mr. Induction	21415 Baker Pkwy. City of Industry, CA 91789	800-330-0388	sunpentown.com	induction burners
Taylor Company	750 N. Blackhawk Rd. Rockton, IL 61072	800-255-0626	taylor-company.com	ice cream machines
Thermo Scientific / Sorvall	81 Wyman St. Waltham, MA 02454	781-622-1000	thermofisher.com	centrifuges, water baths, cryofreezers
ThermoWorks	1762 West 20 S, #100 Lindon, UT 84042	801-756-7705	thermoworks.com	temperature sensors
Vitamix Corp.	8615 Usher Rd. Cleveland, OH 44138	800-848-2649	vitamix.com	Vita-Prep blenders
Vorwerk USA Co.	1964 Corporate Square Longwood, FL 32750	800-562-6726	vorwerk.com	Thermomix blenders
VWR Scientific Products	1310 Goshen Pkwy. West Chester, PA 19380	610-431-1700	vwrsp.com	water baths
Waring Commercial	314 Ella T. Grasso Ave. Torrington, CT 06790	800-492-7464	waringproducts.com	deep fryers
Winston Industries	2345 Carton Dr. Louisville, KY 40299	800-234-5286	winstonind.com	CVaps, pressure fryers
Yamato Scientific America, Inc.	925 Walsh Ave. Santa Clara, CA 95050	408-235-7725	www.yamato-net.co.jp	spray dryers, autoclaves

Meats

Purveyor	Address	Phone	Website	Products
Corfini Gourmet	1730 First Avenue South Seattle, Washington 98134	206-937-3141	corfinigourmet.com	sustainably ranched meats from the Pacific Northwest of North America
Heritage Meats	18241 Pendleton St. SW Rochester, WA 98579	360-273-2202	heritagemeatswa.com	beef, veal
Kapowsin Meat, Inc.	29401 118th Ave. E Graham, WA 98338	253-847-1777		pork
Mad Hatcher Farms	1437 D St. SW Ephrata, WA 98823	509-237-1351		poularde, pigeon, rabbit
Stokesberry Sustainable Farm	7429 85th Lane SE Olympia, WA 98513	360-485-2558	stokesberrysustainablefarm.com	chickens, roosters
Thundering Hooves	2021 Isaacs Ave. Walla Walla, WA 99362	866-350-9400	thunderinghooves.net	pork, beef
Zoe's Meats	133 Copeland St. Petaluma, CA 94952	707-763-9637	zoesmeats.com	meats

Seafood

Purveyor	Address	Phone	Website	Products
Browne Trading Company	Merrill's Wharf 260 Commercial St. Portland, ME 04101	207-766-2404	brownetrading.com	caviar, other seafood
Taylor Shellfish Farm, Inc.	130 SE Lynch Rd. Shelton, WA 98584	360-426-6178	taylorshellfishfarms.com	shellfish, geoduck
True World Foods	24 Link Dr. Rockleigh, NJ 07647	201-750-0024	trueworldfoods.com	shellfish, sashimi-grade fish, other seafood
Wild Salmon Seafood	Fishermen's Terminal 1900 West Nickerson Street #105 Seattle, WA 98119	888-222-FISH	wildsalmonseafood.com	seafood from Alaska and the Pacific Northwest of North America

Other Ingredients

Purveyor	Address	Phone	Website	Products
Chef's Garden	9009 Huron-Avery Rd. Huron, Ohio 44839	800-289-4644	chefs-garden.com	microgreens
Foraged and Found Edibles		866-951-1031	foragedandfoundedibles.com	foraged mushrooms, other produce
Full Circle Farms	31904 N.E. 8th St. Carnation, WA 98014	425-333-4677	fullcirclefarms.com	organic produce
Mikuni Wild Harvest	Queens, NY	866-993-9927	mikuniwildharvest.com	foraged mushrooms, other produce, fish and seafood, oils and vinegars, truffles
Sungrown Organic Distr.	2325 Hollister St. San Diego, CA 92154	619-662-1780	sungrownorganics.com	microgreens

Converting Temperature

To convert temperatures from Celsius to Fahrenheit, multiply by 1.8, then add 32 to the product.

To convert from Fahrenheit to Celsius, subtract 32, then multiply the result by 5/9 (0.56).

Celsius to Fahrenheit		Fahrenheit to Celsius	
(°C)	(°F)	(°F)	(°C)
-196.0	-320.8	-200.0	-128.9
-78.5	-109.3	-80.0	-62.2
-60.0	-76.0	-60.0	-51.1
-40.0	-40.0	-40.0	-40.0
-20.0	-4.0	-20.0	-28.9
0	32.0	0	-17.8
1	33.8	1	-17.2
2	35.6	2	-16.7
3	37.4	3	-16.1
4	39.2	4	-15.6
5	41.0	5	-15.0
6	42.8	6	-14.4
7	44.6	7	-13.9
8	46.4	8	-13.3
9	48.2	9	-12.8
10	50.0	10	-12.2
11	51.8	11	-11.7
12	53.6	12	-11.1
13	55.4	13	-10.6
14	57.2	14	-10.0
15	59.0	15	-9.4
16	60.8	16	-8.9
17	62.6	17	-8.3
18	64.4	18	-7.8
19	66.2	19	-7.2
20	68.0	20	-6.7
21	69.8	21	-6.1
22	71.6	22	-5.6
23	73.4	23	-5.0
24	75.2	24	-4.4
25	77.0	25	-3.9
26	78.8	26	-3.3
27	80.6	27	-2.8

Converting Temperature

Celsius to Fahrenheit		Fahrenheit to Celsius	
(°C)	(°F)	(°F)	(°C)
28	82.4	28	-2.2
29	84.2	29	-1.7
30	86.0	30	-1.1
31	87.8	31	-0.6
32	89.6	32	0.0
33	91.4	33	0.6
34	93.2	34	1.1
35	95.0	35	1.7
36	96.8	36	2.2
37	98.6	37	2.8
38	100.4	38	3.3
39	102.2	39	3.9
40	104.0	40	4.4
41	105.8	41	5.0
42	107.6	42	5.6
43	109.4	43	6.1
44	111.2	44	6.7
45	113.0	45	7.2
46	114.8	46	7.8
47	116.6	47	8.3
48	118.4	48	8.9
49	120.2	49	9.4
50	122.0	50	10.0
51	123.8	51	10.6
52	125.6	52	11.1
53	127.4	53	11.7
54	129.2	54	12.2
55	131.0	55	12.8
56	132.8	56	13.3
57	134.6	57	13.9
58	136.4	58	14.4
59	138.2	59	15.0
60	140.0	60	15.6
61	141.8	61	16.1
62	143.6	62	16.7
63	145.4	63	17.2
64	147.2	64	17.8
65	149.0	65	18.3
66	150.8	66	18.9
67	152.6	67	19.4
68	154.4	68	20.0

Converting Temperature

Celsius to Fahrenheit		Fahrenheit to Celsius	
(°C)	(°F)	(°F)	(°C)
69	156.2	69	20.6
70	158.0	70	21.1
71	159.8	71	21.7
72	161.6	72	22.2
73	163.4	73	22.8
74	165.2	74	23.3
75	167.0	75	23.9
76	168.8	76	24.4
77	170.6	77	25.0
78	172.4	78	25.6
79	174.2	79	26.1
80	176.0	80	26.7
81	177.8	81	27.2
82	179.6	82	27.8
83	181.4	83	28.3
84	183.2	84	28.9
85	185.0	85	29.4
86	186.8	86	30.0
87	188.6	87	30.6
88	190.4	88	31.1
89	192.2	89	31.7
90	194.0	90	32.2
91	195.8	91	32.8
92	197.6	92	33.3
93	199.4	93	33.9
94	201.2	94	34.4
95	203.0	95	35.0
96	204.8	96	35.6
97	206.6	97	36.1
98	208.4	98	36.7
99	210.2	99	37.2
100	212	100	37.8
105	221	105	40.6
110	230	110	43.3
115	239	115	46.1
120	248	120	48.9
125	257	125	51.7
130	266	130	54.4
135	275	135	57.2
140	284	140	60.0
145	293	145	62.8

Converting Temperature

Celsius to Fahrenheit		Fahrenheit to Celsius	
(°C)	(°F)	(°F)	(°C)
150	302	150	65.6
155	311	155	68.3
160	320	160	71.1
165	329	165	73.9
170	338	170	76.7
175	347	175	79.4
180	356	180	82.2
185	365	185	85.0
190	374	190	87.8
195	383	195	90.6
200	392	200	93.3
205	401	205	96.1
210	410	210	98.9
215	419	215	101.7
220	428	220	104.4
225	437	225	107.2
230	446	230	110.0
235	455	235	112.8
240	464	240	115.6
245	473	245	118.3
250	482	250	121.1
255	491	255	123.9
260	500	260	126.7
265	509	265	129.4
270	518	270	132.2
275	527	275	135.0
280	536	280	137.8
285	545	285	140.6
290	554	290	143.3
295	563	295	146.1
300	572	300	148.9

USEFUL TEMPERATURES

Boiling point of liquid nitrogen:
-196 °C / **-321** °F
Sublimation temperature of dry ice:
-78.5 °C / **-109.3** °F
Freezing point of water:
0 °C / **32** °F
Boiling point of water at sea level:
100 °C / **212** °F

Converting Grams to Volume for Common Ingredients

To convert the weights given in our recipes to volumetric measurements, divide the number of grams by the conversion factor below.

	1 ml	1 tsp	1 Tbsp	½ cup	1 cup
PANTRY ITEMS					
Flours and Starches					
00 flour	0.68	3.3	10.0	80	160
all-purpose flour	0.34	1.7	5.0	40	80
almond flour	0.57	2.8	8.4	68	135
buckwheat flour, sifted	0.55	2.7	8.1	65	130
cake flour	0.49	2.4	7.3	59	117
chickpea flour, sifted	0.56	2.8	8.3	66	132
cornmeal	0.67	3.3	9.9	79	158
cornstarch	0.03	0.2	0.5	4	8
durum flour	0.63	3.1	9.4	75	150
gluten flour	0.04	0.2	0.6	5	10
rice flour, glutinous	0.49	2.4	7.3	59	117
rice flour, sweet	0.63	3.1	9.4	75	150
semolina	0.79	3.9	11.7	94	187
tapioca	0.72	3.5	10.6	85	170
Grains and Legumes					
barley	0.70	3.5	10.4	83	166
brown rice crisp	0.15	0.8	2.3	18	36
chickpeas	0.85	4.2	12.5	100	200
lentils, black (urad dal)	0.85	4.2	12.5	100	200
lentils, green	0.87	4.3	12.9	104	207
oats, rolled	0.42	2.1	6.3	50	100
oats, steel-cut	0.75	3.7	11.1	89	178
oats, toasted	0.42	2.1	6.3	50	100
peas, black-eyed	0.85	4.2	12.5	100	200
quinoa	0.75	3.7	11.1	89	178
rice, Arborio	0.89	4.4	13.1	105	210
rice, basmati	0.79	3.9	11.8	94	188
rice, jasmine	0.83	4.1	12.3	98	196
rice, paella	0.80	4.0	11.9	95	190
rice, sushi	0.90	4.4	13.3	106	212
rice, wild	0.74	3.6	10.9	88	175
rye, berries	0.78	3.9	11.6	93	185
rye, cracked	0.68	3.3	10.0	80	160
soy beans	0.40	2.0	5.9	48	95
tapioca, small pearl	0.75	3.7	11.1	89	178

Converting Weights

To convert weights from grams to ounces, divide by 28.35. To convert from ounces to grams, multiply by 28.35.

Grams to ounces		Ounces to grams	
(g)	(oz)	(oz)	(g)
0.1	0.004	0.1	2.8
0.2	0.007	0.2	5.7
0.3	0.011	0.3	8.5
0.4	0.014	0.4	11.3
0.5	0.018	0.5	14.2
0.6	0.021	0.6	17.0
0.7	0.025	0.7	19.8
0.8	0.028	0.8	22.7
0.9	0.032	0.9	25.5
1	0.035	1	28.4
2	0.071	2	56.7
3	0.106	3	85.1
4	0.141	4	113.4
5	0.176	5	141.8
6	0.212	6	170.1
7	0.247	7	198.5
8	0.282	8	226.8
9	0.317	9	255.2
10	0.353	10	283.5
11	0.388	11	311.9
12	0.423	12	340.2
13	0.459	13	368.6
14	0.494	14	396.9
15	0.529	15	425.3
16	0.564	16	453.6
17	0.600	17	482.0
18	0.635	18	510.3
19	0.670	19	538.7
20	0.705	20	567.0
21	0.741	21	595.4
22	0.776	22	623.7
23	0.811	23	652.1
24	0.847	24	680.4
25	0.882	25	708.8
30	1.058	30	850.5

Converting Weights

Grams to ounces		Ounces to grams	
(g)	(oz)	(oz)	(g)
35	1.235	35	992.3
40	1.411	40	1,134.0
45	1.587	45	1,275.8
50	1.764	50	1,417.5
55	1.940	55	1,559.3
60	2.116	60	1,701.0
65	2.293	65	1,842.8
70	2.469	70	1,984.5
75	2.646	75	2,126.3
80	2.822	80	2,268.0
85	2.998	85	2,409.8
90	3.175	90	2,551.5
95	3.351	95	2,693.3
100	3.527	100	2,835.0
110	3.880	110	3,118.5
120	4.233	120	3,402.0
130	4.586	130	3,685.5
140	4.938	140	3,969.0
150	5.291	150	4,252.5
160	5.644	160	4,536.0
170	5.996	170	4,819.5
180	6.349	180	5,103.0
190	6.702	190	5,386.5
200	7.055	200	5,670.0
250	8.818	250	7,087.5
300	10.582	300	8,505.0
350	12.346	350	9,922.5
400	14.109	400	11,340.0
450	15.873	450	12,757.5
500	17.637	500	14,175.0
550	19.400	550	15,592.5
600	21.164	600	17,010.0
650	22.928	650	18,427.5
700	24.691	700	19,845.0
750	26.455	750	21,262.5
800	28.219	800	22,680.0
850	29.982	850	24,097.5
900	31.746	900	25,515.0
950	33.510	950	26,932.5
1,000	35.273	1,000	28,350.0
1 pound = 453.59 g / 16 oz; 1 kg = 2.2 lb			

Converting Grams to Volume for Common Ingredients

	1 ml	1 tsp	1 Tbsp	½ cup	1 cup
Liquids					
cocoa butter	0.58	2.9	8.6	69	138
cream, whipping	0.91	4.5	13.4	108	215
crème fraîche	0.96	4.8	14.3	114	228
milk, 1% fat	0.98	4.8	14.5	116	232
milk, 2% fat	0.93	4.6	13.7	110	219
milk, skim	0.98	4.8	14.5	116	232
milk, soy	0.97	4.8	14.4	115	230
milk, whole	0.97	4.8	14.4	115	230
oils	0.78	3.9	11.6	93	185
vinegars	0.86	4.3	12.8	102	204
vodka	0.80	4.0	11.9	95	190
water	0.97	4.8	14.4	115	230
wine	0.89	4.4	13.1	105	210
Nuts					
almonds, blanched	0.61	3.0	9.1	73	145
almonds, marcona, roasted	0.55	2.7	8.1	65	130
cashews, roasted	0.72	3.5	10.6	85	170
hazelnuts, peeled and roasted	0.64	3.2	9.5	76	152
macadamia nuts, roasted	1.14	5.6	16.9	135	270
pine nuts, roasted	0.61	3.0	9.1	73	145
pistachios, peeled and roasted	0.51	2.5	7.5	60	120
walnuts, roasted	0.38	1.9	5.6	45	90
Sauces and Syrups					
barley malt	1.69	8.3	25.0	200	400
ketchup	1.19	5.9	17.6	141	282
maple syrup	1.45	7.2	21.5	172	344
molasses	1.45	7.2	21.5	172	344
soy sauce, brown	1.08	5.3	16.0	128	256
soy sauce, white	1.08	5.3	16.0	128	256
tomato paste	1.12	5.5	16.6	133	265
Worcestershire sauce	1.19	5.9	17.6	141	282
Sugars					
agave nectar	1.45	7.2	21.5	172	344
fructose	0.82	4.1	12.2	98	195
glucose	1.45	7.2	21.5	172	344
honey	1.45	7.2	21.5	172	344
isomalt	0.95	4.7	14.1	113	225
sugar, brown	0.72	3.5	10.6	85	170
sugar, Demerara	0.70	3.5	10.4	83	166

Converting Grams to Volume for Common Ingredients

	1 ml	1 tsp	1 Tbsp	½ cup	1 cup
sugar, granulated	0.87	4.3	12.8	103	205
sugar, muscovado	1.08	5.3	15.9	128	255
sugar, palm	0.82	4.1	12.2	98	195
sugar, powdered	0.49	2.4	7.2	58	115
sugar, raw cane	0.98	4.8	14.5	116	232
SEASONINGS					
Chilies, Dry					
Aleppo peppers, crushed	0.50	2.5	7.4	59	118
black peppercorns, ground	0.32	1.6	4.8	38	77
black peppercorns, whole	0.61	3.0	9.0	72	144
cayenne, powder	0.41	2.0	6.0	48	96
Hungarian paprika, powder	0.37	1.8	5.5	44	88
pimentón de la Vera, powder	0.41	2.0	6.0	48	96
pink peppercorns, whole	0.44	2.3	6.5	52	104
red chili, powder	0.51	2.5	7.5	60	120
Sichuan pepper, crushed	0.47	2.3	7.0	56	112
Thai chili, flakes	0.37	1.8	5.5	44	88
white peppercorns, whole	0.68	3.3	10.0	80	160
Herbs and Aromatics, Fresh, Minced					
basil	0.39	1.9	5.8	47	93
chamomile, dry blossoms, powder	0.20	1.0	3.0	24	48
chamomile, dry blossoms, whole	0.10	0.5	1.5	12	24
cilantro	0.51	2.5	7.5	60	120
elderberry, dry	0.47	2.3	7.0	56	112
garlic	1.15	5.7	17.0	136	272
hawthorne berries	0.61	3.0	9.0	72	144
heather tips	0.17	0.8	2.5	20	40
juniper berries	0.47	2.3	7.0	56	112
lavender	0.14	0.7	2.0	16	32
lemon zest, grated	0.64	3.2	9.5	76	152
lemongrass, minced	0.47	2.3	7.0	56	112
licorice root, chunks	0.41	2.0	6.0	48	96
lime zest, grated	0.64	3.2	9.5	76	152
mint	0.20	1.0	3.0	24	48
orange zest	0.64	3.2	9.5	76	152
oregano	0.39	1.9	5.8	47	93
parsley	0.51	2.5	7.5	60	120
rosemary	0.39	1.9	5.8	47	93
shallots	0.49	2.4	7.3	59	117

Common Conversion Factors

To convert from:	To:	Multiply by:
ml	tsp	0.203
tsp	ml	4.93
ml	Tbsp	0.068
Tbsp	ml	14.787
ml	cup	0.004
cup	ml	236.59
tsp	cup	0.021
cup	tsp	48
Tbsp	cup	0.063
cup	Tbsp	16
ml	oz	0.034
oz	ml	29.574
pint	qt	0.25
qt	pint	4
qt	gal	0.25
gal	qt	4
qt	l	0.946
l	qt	1.057
l	gal	0.264
gal	l	3.785
oz	lb	0.063
lb	oz	16
g	oz	0.035
oz	g	28.35
g	lb	0.002
lb	g	453.592
oz	kg	0.028
kg	oz	35.274
lb	kg	0.454
kg	lb	2.2
mm	in	0.394
in	mm	25.4
cm	in	0.394
in	cm	2.54
m	ft	3.3
ft	m	0.305
s	min	0.017
J	BTU	0.001
BTU	J	1,055.10
kcal	BTU	3.966
BTU	kcal	0.252

Converting Grams to Volume for Common Ingredients

	1 ml	1 tsp	1 Tbsp	½ cup	1 cup
tarragon	0.34	1.7	5.0	40	80
Thai chili, minced	0.41	2.0	6.0	48	96
winter greens, dry	0.24	1.2	3.5	28	56
Herbs, Dry					
oregano	0.17	0.8	2.5	20	40
rosemary	0.20	1.0	3.0	24	48
savory	0.20	1.0	3.0	24	48
Salts					
salt, Bali pyramid	0.81	4.0	12.0	96	192
salt, black	0.68	3.3	10.0	80	160
salt, fine sea	1.14	6.2	18.5	135	270
salt, kosher	1.06	5.8	17.6	125	250
salt, Maldon	0.81	4.0	12.0	96	192
salt, sea	0.74	3.7	11.0	88	176
salt, sumac	0.81	4.0	12.0	96	192
Spices, Dry					
ajowan seed, powder	0.56	2.8	8.3	66	132
ajowan seed, whole	0.56	2.8	8.3	67	133
angelica seed, whole	0.09	0.5	1.4	11	22
barley malt vinegar, powder	0.57	2.8	8.5	68	136
caraway seed	0.52	2.6	7.8	62	124
cardamom seed, green	0.57	2.8	8.5	68	136
cassia, chunks	0.64	3.2	9.5	76	152
celery seed	0.47	3.0	7.0	56	112
chaat masala	0.64	3.2	9.5	76	152
chicory	0.44	2.2	6.5	52	104
cinnamon, powder	0.46	2.3	6.8	55	109
clove, powder	0.47	2.3	7.0	56	112
clove, whole	0.44	2.2	6.5	52	104
cocoa nib	0.54	2.7	8.0	64	128
cocoa powder	0.57	2.8	8.4	68	135
coconut cream, powder	0.37	1.8	5.5	44	88
coriander seed	0.34	1.7	5.0	40	80
cumin, black	0.46	2.3	6.8	55	109
cumin, powder	0.54	2.7	8.0	64	128
cumin, whole	0.23	1.1	3.4	27	54
fennel seed, powder	0.44	2.2	6.5	52	104
fennel seed, whole	0.79	3.9	11.7	94	187
fenugreek seed	0.95	4.7	14.0	112	224
four-spice, powder	0.41	2.0	6.0	48	96

Common Conversion Factors

To convert from:	To:	Multiply by:
kcal	J	4,184
J	kcal	0.000
W	BTU/h	0.001
BTU/h	W	1,055.04
W	hp	0.001
hp	W	745.7
g/cm^3	oz/in^3	0.578
oz/in^3	g/cm^3	1.73
N	lb force	0.225
lb force	N	4.482
mbar	torr	0.75
torr	mbar	1.333
mbar	psi	0.015
psi	mbar	68.95
bar	psi	14.5
psi	bar	0.069
Pa	mbar	0.01
mbar	Pa	100
bar	atm	0.987
atm	bar	1.013

Converting Volume Measures

Metric	U.S.	Imperial	
(ml)		(pint)	(fl oz)
5	1 tsp		⅕
15	1 Tbsp		½
30	2 Tbsp		1
60	¼ cup	⅛	2
90	⅓ cup	⅓	3
120	½ cup	⅕	4
150	⅔ cup	¼	5
180	¾ cup	⅓	6
240	1 cup	⅖	8
300	1¼ cups	½	10
480	2 cups	⅔	16
600	2½ cups	1	20
1,000	1 quart	4	32

Converting Grams to Volume for Common Ingredients

	1 ml	1 tsp	1 Tbsp	½ cup	1 cup
garum masala, powder	0.54	2.7	8.0	64	128
ginger, powder	0.37	1.8	5.5	44	88
grains of paradise, whole	0.68	3.3	10.0	80	160
licorice, powder	0.51	2.5	7.5	60	120
mace, powder	0.34	1.7	5.0	40	80
mace, whole	0.41	2.0	6.0	48	96
mustard seed, black, whole	0.74	3.7	11.0	88	176
mustard seed, yellow, whole	0.74	3.7	11.0	88	176
nigella seed, whole	0.78	3.8	11.5	92	184
nutmeg, powder	0.44	2.2	6.5	52	104
pomegranate seed, whole	0.81	4.0	12.0	96	192
poppy seed, black	0.57	2.8	8.5	68	136
poppy seed, black or white	0.54	2.7	8.0	64	128
porcini mushroom, powder	0.51	2.5	7.5	60	120
saffron, threads	0.20	1.0	3.0	24	48
scallop, freeze-dried, powder	0.37	1.8	5.5	44	88
sesame seed, black	0.54	2.7	8.0	64	128
sesame seed, roasted	0.54	2.7	8.0	64	128
star anise, powder	0.44	2.2	6.5	52	104
tamarind, powder	0.47	2.3	7.0	56	112
tomato, freeze-dried, powder	0.61	3.0	9.0	72	144
turmeric, powder	0.51	2.5	7.5	60	120
Dairy					
butter	0.95	4.7	14.1	113	225
cream cheese	0.89	4.4	13.1	105	210
crème fraîche	0.95	4.7	14.1	113	225
Gruyère, grated	0.38	1.9	5.6	45	90
mascarpone	0.95	4.7	14.1	113	225
Parmesan, grated	0.30	1.5	4.4	35	70
ricotta	1.04	5.1	15.4	124	247
Eggs					
chicken egg, blended	0.98	5.8	17.5	116	232
chicken egg, large, white	0.91	4.5	13.4	108	215
chicken egg, large, yolk	0.85	4.2	12.5	100	200
Fish					
fish, ground	0.97	4.8	14.4	115	230
roe, steelhead trout	1.50	7.5	22.3	178	357
shrimp, ground	0.96	4.7	14.1	113	226
tobiko	0.80	3.9	11.8	94	189

Water Content of Typical Foods

Food	Water content (%)
Animal Foods	
beef, eye of round, raw	73
beef, ground, 73% lean, raw	56
beef, ground, 85% lean, raw	64
beef, whole brisket, raw	71
butter or margarine	20
cheese, American	37
chicken fryer, whole, raw	66
chicken, dark meat, with skin, raw	66
chicken, white meat, with skin, raw	69
eggs, raw, whole	74
ham, cooked	54
milk, cow	87
pork, chops, broiled	45
turkey, roasted	62
veal, broiled	60
Fruits	
apple, raw	84
apricot, raw	86
banana, raw	75
blackberry, raw	86
blueberry, raw	85
cantaloupe, raw	90
cherry, raw	80
cranberry, raw	87
fruit cocktail, canned	80
grape, raw	82
grapefruit, raw	90
mango, raw	82
melon, honeydew, raw	90
orange, raw	87
papaya, raw	89
peach, raw	88
pear, raw	84
pineapple, raw	85
plum, raw	85
raspberry, raw	81

Water Content of Typical Foods

Food	Water content
	(%)
strawberry, raw	92
watermelon, raw	93
Grains, Legumes, Nuts, and Seeds	
almonds, raw	7
bread, whole wheat	35
coconut, dried	7
grains/legumes/seeds, dry	≤10
lentils, cooked	67
macaroni or spaghetti, cooked	70
pecans, raw	7
rice, bleached	68
walnuts, raw	4
Herbs	
cilantro, raw	92
parsley, raw	86
Sweeteners	
honey	15
jam/preserves	30
molasses	25
Vegetables	
asparagus, raw	92
bean sprout, raw	92
bean, green, raw	90
beet, raw	87
bok choy, raw	95
broccoli, raw	91
Brussels sprout, raw	86
cabbage, raw	92
carrot, raw	88
cassava, raw	60
cauliflower, raw	92
celery, raw	95
corn, sweet, fresh, raw	74
cucumber, raw	96
eggplant, raw	92
greens, beet, raw	92
greens, collard, raw	91
greens, dandelion, raw	86

Water Content of Typical Foods

Food	Water content
	(%)
greens, turnip	91
kale, raw	87
lettuce, iceberg, raw	96
lettuce, loose leaf, raw	94
lettuce, romaine, raw	95
mushroom, raw	92
okra, boiled or raw	90
olives	80
onions, raw	89
parsnip, raw	80
peas, green, raw	80
peppers, bell	92
pickle, cucumber	93
potato, raw	85
pumpkin, canned	90
pumpkin, raw	92
radish, raw	95
rutabaga, boiled	90
sauerkraut, canned	93
spinach, raw	92
squash, acorn, raw	88
squash, boiled	96
squash, butternut	94
squash, kabocha, raw	94
squash, spaghetti	94
squash, yellow	94
sweet potato, boiled in skin	71
sweet potato, raw	73
Swiss chard	94
tomato, raw	93
watercress, raw	90
zucchini	95

Converting Grams to Volume for Ingredients

	1 ml	1 tsp	1 Tbsp	½ cup	1 cup
Meat, Ground					
beef	1.27	6.3	18.8	150	300
chicken, breast	1.06	5.2	15.6	125	250
chicken, thigh	1.06	5.2	15.6	125	250
pork	1.27	6.3	18.8	150	300
Vegetables and Fruits					
apple, thinly sliced	0.49	2.4	7.2	58	115
avocado, puree	0.91	4.5	13.4	108	215
butternut squash, brunoise	0.05	0.2	0.7	6	11
butternut squash, thinly sliced	0.66	3.2	9.7	78	155
cabbage, red, thinly sliced	0.42	2.1	6.3	50	100
cabbage, white, thinly sliced	0.42	2.1	6.3	50	100
cantaloupe, thinly sliced	0.91	4.5	13.4	108	215
carrot, thinly sliced	0.42	2.1	6.3	50	100
cauliflower, thinly sliced	0.51	2.5	7.5	60	120
celery, thinly sliced	0.42	2.1	6.3	50	100
corn, kernels	0.76	3.8	11.3	90	180
fennel, thinly sliced	0.38	1.9	5.6	45	90
honeydew melon, thinly sliced	0.91	4.5	13.4	108	215
leek, thinly sliced	0.38	1.9	5.6	45	90
mushroom, button, thinly sliced	0.36	1.8	5.3	43	85
onion, thinly sliced	0.44	2.2	6.6	53	105
pea, green, shelled	0.68	3.3	10.0	80	160
pear, thinly sliced	0.72	3.5	10.6	85	170
pineapple, brunoise	0.08	0.4	1.2	9	18
pineapple, thinly sliced	0.82	4.1	12.2	98	195
scallion, thinly sliced (green part)	0.30	1.5	4.4	35	70
scallion, thinly sliced (white part)	0.41	2.0	6.1	49	98
shiitake mushroom, thinly sliced	0.27	1.4	4.1	33	65
tomatoes concassé	0.91	4.5	13.4	108	215

Fat Content of Typical Foods

Typical Food	Fat Content (%)
Eggs, Dairy, and Oils	
butter	87
cheese, aged, firm	25–31
cheese, aged, soft	23–35
cheese, Camembert	23
cheese, cheddar	31
cheese, cottage	4
cheese, cream	20
cheese, fresh	2–18
cheese, mozzarella	19
cheese, Parmesan	24–26
cheese, ricotta	13
cream, double	>38
cream, half-and-half	11–17
cream, heavy	38
cream, light whipping	32–36
cream, sour	12
crème fraîche	28
egg white	0.2
egg yolk	26
milk, cow	3.5
milk, goat	4.5
milk, grey seal	53
milk, low fat	2
milk, reindeer	17
milk, sheep	7
milk, skim	0
milk, water buffalo	9.5
milk, whole	3.5–4
oil, refined	99
oil, unrefined	96–99
Meats, Raw	
bacon	50–70
bacon, Canadian	1–4
bone marrow	75
brain	8
foie gras	45–52
heart	3
kidneys	20

Fat Content of Typical Foods

Typical Food	Fat Content (%)
liver, chicken	4
liver, veal	7
pork, backfat	80
pork, fatty	30
pork, lean	1.5–2
red meat, lean	4
red meat, marbled	10
red poultry (duck, goose, pigeon), breast meat, skinless	1–1.5
red poultry, leg meat	12
sweetbreads	15–18
tongue	15
veal, lean	3
white poultry (chicken, turkey), dark meat	6.5
white poultry, white meat	1–1.5
Fish and Shellfish	
cod	1
mackerel	5
rockfish	3
salmon	5–10
sardine	5
shellfish	1
tuna, belly	12–15
tuna, lean	1
whitefish	1–3
Nuts and Seeds	
almonds	55
cashews	44
coconut	57
hazelnuts	64
kukui nuts (candlenuts)	64
macadamia nuts	74
olives	3
peanuts	44
pecans	70
pistachios	55

Fat Content of Typical Foods

Typical Food	Fat Content (%)
sesame seeds	48
sunflower seeds	50
walnuts	61
Other Plant Foods	
avocado	14
bread, whole wheat	4.2
chickpeas, cooked	2
corn	2.7–8
fruit	<1
grains	0.15
lentils, boiled	0.5
vegetables	<1

Volumetric Equivalents for Amounts of Typical Foods

Typical food	Weight or amount	Equivalent (approximate)
asparagus spears, fresh	1 lb	16 to 20 spears
bananas, fresh	1 lb	3–4 fruits; 2 cups sliced; or 1½ cups mashed
beans, green, fresh	1 lb	3 cups
beans, kidney, dried	1 lb	2½ cups
beans, navy, dried	1 lb	2⅓ cups; 5⅓ cups, cooked
beans, soy, dried	1 lb	2 cups
bread crumbs, dry	4 oz	¾ cup
bread crumbs, fresh	4 oz	2 cups
broccoli, fresh	1 lb	2 cups, chopped
carrots/root vegetables, pureed	1 lb	1⅓ cups
carrots/root vegetables, sliced	1 lb	3 cups
cheese	3½ oz	1 cup
coffee, ground	1 lb	80 Tbsp
corn, fresh	2 medium ears	1 cup of kernels
eggs, whole, extra large	1 dozen	3 cups
eggs, whole, large	1 dozen	2⅓ cups
eggs, whole, medium	1 dozen	2 cups
eggs, whole, small	1 dozen	1¾ cups
egg whites, extra large	1 dozen	1¾ cups
egg whites, large	1 dozen	1½ cups
egg whites, medium	1 dozen	1⅓ cups
egg whites, small	1 dozen	1¼ cups
egg yolks, extra large	1 dozen	1 cup
egg yolks, large	1 dozen	⅞ cup
egg yolks, medium	1 dozen	¾ cup
egg yolks, small	1 dozen	⅔ cup
fats, solid (butter, shortening, etc.)	¼ lb; 4 oz	½ cup; 8 Tbsp; 1 stick
flours	1 lb	3½ cups, sifted
fruit, dried, pitted, plumped	1 lb	2⅔ cups
fruit, dried, pitted, cooked, pureed	1 lb	2⅓ cups
fruit, fresh, cooked and chopped	1 lb	2⅓ cups
fruit, fresh, pureed	1 lb	1¼ cups
fruit, fresh, raw and sliced	1 lb	3 cups
gelatin, unflavored	1 oz	¼ cup; 4 Tbsp, granulated
greens, leafy	1 lb	1½ cups
herbs, fresh, chopped	½ oz	1 Tbsp
honey	1 lb	1⅓ cups
maple syrup	16 fl oz	2 cups

Volumetric Equivalents for Amounts of Typical Foods

Typical food	Weight or amount	Equivalent (approximate)
meat, cooked and finely chopped	8 oz	1 cup
nuts, chopped	4 oz	¾ cup
nuts, ground	4 oz	1 cup, loosely packed
oil, vegetable	1 qt	4 cups
onions, white, fresh	1 lb	4 medium; 2–3 cups, chopped
peas, green, fresh, in pod	1 lb	1 cup, shelled
pecans	1 lb	4 cups, halved; 3¾ cups, chopped
pistachios	1 lb	3¼–4 cups
potatoes, raw, sliced or chopped	1 lb	3 cups
rice, raw	7½ oz	1 cup
spinach, fresh, cooked	1¼ lb, raw	1 cup, cooked, squeezed dry, chopped
sugar, brown	1 lb	1½ cups
sugar, confectioner's	1 lb	4 cups
sugar, granulated	7 oz	1 cup
tomatoes, fresh	¾–1 lb, whole	1 cup, peeled and seeded
vegetables (e.g., carrots, celery), raw, chopped fine	8 oz	1 cup

All conversions are approximate. Weights have been rounded to the nearest useful measure. Weights and measures of specific ingredients may vary with altitude, humidity, variations in preparation methods, and other factors.

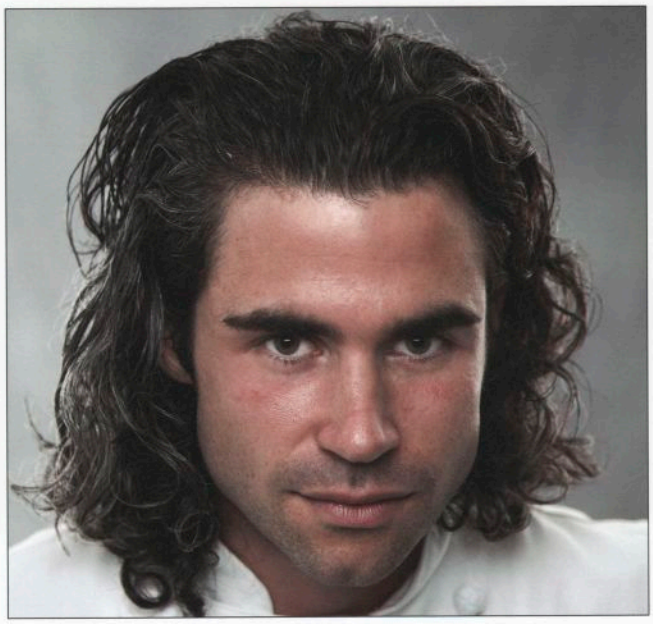
THE *MODERNIST CUISINE* TEAM

Modernist Cuisine is—let's face it—a massive book. Creating it required a commensurately massive effort, including years of work (often into the wee hours of the night) by a team that grew to encompass two dozen writers and editors; a dozen people working on design, photography, and illustration; a half-dozen full-time chefs; and more than a dozen external expert reviewers. Working with so many people of such tremendous skill and dedication has been an honor.

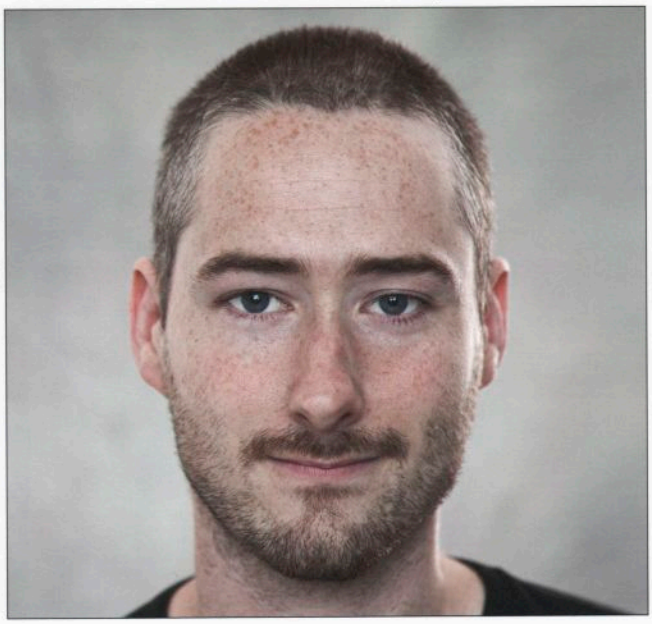
Nathan Myhrvold

Chris Young

Maxime Bilet



Ryan Matthew Smith



WRITING AND EDITING

Wayt Gibbs

As the editor-in-chief and project manager for the book, Mr. Gibbs recruited the writing and editing team and supervised all editorial, illustration, and production work on the volumes. He also participated in the editing of every part of the book. Executive editor at Intellectual Ventures since 2006, Mr. Gibbs was an editor and senior writer at *Scientific American* magazine from 1992 to 2006.

Karen Wright

A senior writer at Intellectual Ventures since 2009, Ms. Wright has been a contributing editor at *Discover* magazine since 2000 and was also a member of the board of editors at *Scientific American* magazine as well as a correspondent for *Nature* and *Science*.

Steven Ashley

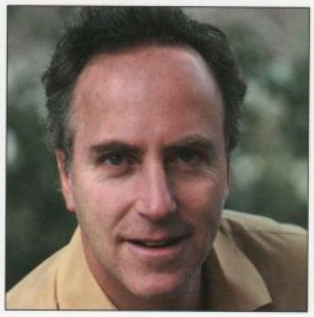
A features editor for many years and now a contributing editor at *Scientific American,* Mr. Ashley also writes for *The New York Times* and *Automotive Engineering International.* An avid home cook, he mixes science with the conventional kitchen techniques he learned from his Italian mother and Dutch-German grandmother.

Ellen Kurek

An editor at Intellectual Ventures since 2008, Ms. Kurek was lead copy editor on the project. She is certified as an Editor in the Life Sciences (ELS), has completed the American Medical Writers Association core curriculum in editing and writing, and has edited and written extensively for the medical press.

Tracy Cutchlow

An editor based in Seattle, Ms. Cutchlow edited the books *Brain Rules* and *Brain Rules for Baby* by John Medina (Pear Press).



Ivan Amato

Mr. Amato, an author of several books on science who now works for The Pew Charitable Trust, has been a staff writer on several magazines, including *Science News* and *Science*. He also served as managing editor of *Chemical & Engineering News*.

Rebekah Denn

The recipient of two James Beard Awards, Ms. Denn was food writer and restaurant critic for the *Seattle Post-Intelligencer.*

Amy Fass

A science editor who has worked with the Environmental Protection Agency, the American National Standards Institute, *IEEE Spectrum,* and *Hospital Medicine,* Ms. Fass wrote the medical entries and edited the math, astronomy, language, and chemistry entries for Merriam-Webster's Collegiate Encyclopedia.

Sharon Silva

One of the most experienced cookbook editors in the United States, Ms. Silva copy edited Chef Grant Achatz's book *Alinea.* She served as lead editor for the plated-dish recipes in volume 5.

Bryn Nelson

A Ph.D. in microbiology and former science writer at *Newsday,* Dr. Nelson is now a Seattle-based freelance science and medical writer and has written for MSNBC.com and *Nature,* among other publications.

Christy Harrison

Web editor for *Gourmet* magazine from 2007 to 2009, Ms. Harrison was also food editor and senior editor at *Plenty* magazine. She worked on *Modernist Cuisine* while also pursuing a master in public health (concentration in nutrition) and a registered dietitian license at New York University.

Cynthia Nims

Ms. Nims is a well-known Seattle food writer who has authored six books of her own, including the *Northwest Homegrown Cookbook Series.*

Greg Huang

Formerly a features editor at *New Scientist* magazine and senior writer for *Technology Review,* Dr. Huang is an editor at *Xconomy.* He has a Ph.D. in electrical engineering and computer science from the Massachusetts Institute of Technology.

Tom Paulson

For nearly 25 years, Mr. Paulson covered science for the *Seattle Post-Intelligencer,* and he was the paper's senior science reporter when it closed in 2009.

Leah Kauffman

Ms. Kauffman is a freelance science writer in Pittsburgh who frequently writes for universities and nonprofit organizations.

Carol Reed

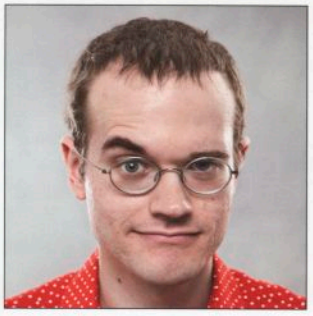
A copy editor at magazines such as *BusinessWeek* and book publishers such as HarperCollins, Ms. Reed was the copy chief at *HomeStyle* magazine. For nearly 15 years, she was an Athens-based correspondent for major news media. A former professional chef, she studied at the French Culinary Institute in New York.

Rebecca Kennedy

Ms. Kennedy holds a master of library science from Indiana University and was a reference librarian for the Chicago Public Library, where one of her responsibilities was selecting materials on cooking and food.

David Schneider

Currently a senior editor at *IEEE Spectrum* magazine, Dr. Schneider has also worked as an editor at *American Scientist* and *Scientific American* magazines. His doctoral degree, from Columbia University, is in geophysics. Dr. Schneider assisted with analysis of research data as well as writing and editing.



Aaron Shattuck

Mr. Shattuck is a copy editor, editor, writer, fact checker, and cartoonist based in New York City. He has worked at *Scientific American*, *Scientific American Mind*, *Science Illustrated*, *Popular Science*, and *IEEE Spectrum*.

Robert L. Wolke

A professor emeritus of nuclear chemistry at the University of Pittsburgh, Dr. Wolke is author of a chemistry textbook and four popular science books, including *What Einstein Told His Cook*. For 10 years, Dr. Wolke wrote a James Beard Journalism Award-winning column on kitchen science for the *Washington Post*.

Susan Volland

Trained as a chef, Ms. Volland is also a published cookbook author and novelist now working as a freelance writer, editor, and specialist in original recipe development.

Deborah Patton and Alexandra Nickerson

A freelance indexer of books and journals since 1994, Ms. Patton worked with veteran indexer Ms. Nickerson to create the index. Ms. Nickerson has indexed many books on food, including books by Shirley Corriher and Anne Willan, as well as culinary science books by Harold McGee and Robert Wolke.

Other writers, editors, and researchers

Angela Evans, Karen Hopkin, Barbara Jatkola, Sujung Lim, Christina Miller, Rachel Tompa, Sarah Richardson, Daniel McCoy

PHOTOGRAPHY, DESIGN, LAYOUT, AND ILLUSTRATION

Mark Clemens

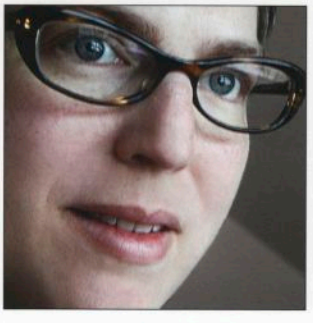
Mr. Clemens has worked at *Men's Journal, Popular Science, Women's Wear Daily, New York* magazine, *Ladies' Home Journal, Musician*, and other magazines. He was the design director at *Scientific American* magazine from 1999 until 2009, when he joined Intellectual Ventures as art director. Mr. Clemens developed the design, typography, and style for the volumes and oversaw all aspects of information graphics, layout, and production.

Melissa Lehuta

Before joining Intellectual Ventures, Ms. Lehuta studied food and product photography at The Art Institute of Seattle, where she received a Best in Portfolio award in 2008. Ms. Lehuta was one of the lead photo editors for the book.

Ann Chin

An editorial and art assistant at *Scientific American* since 2008, Ms. Chin previously worked as a copy editor and reporter in the business news industry. She assisted with photo research and permissions management for the project.



Jen Christiansen

Art director of informational graphics at *Scientific American*, Ms. Christiansen has worked as an art director and designer for *National Geographic* and has specialized in developing scientific illustrations for various magazines and textbooks.

Ted Ellis

Mr. Ellis is a senior machinist and instrument maker at Intellectual Ventures Laboratory. He did disassembly, cutting, and reassembly of the culinary equipment in the book's cutaway photos.

Mike Vinton

Mr. Vinton heads the instrument shop at Intellectual Ventures Laboratory. He previously worked on nuclear reactors, the tunneling machine used to dig the Chunnel, and detectors for the Large Hadron Collider in Switzerland. He helped plan and manufacture all the mechanical cutaways used in the book.

Richard Hunt

As managing production editor for Nature Publishing Group, Mr. Hunt oversees typesetting of *Scientific American* magazine and other publications. He served as lead typesetter for this book.

Özgür Yıldırım

Dr. Yıldırım created computer models of cooking phenomena for the book. He has a master's degree in food engineering from Cornell University and a doctorate in chemical engineering from Purdue University.

Janel Kiley

A freelance designer based in Washington, D.C., Ms. Kiley assisted with design, layout, and typesetting.

Other designers, illustrators, microscopists, and machinists

Barçın Acar, David Fierstein, Johnny Johnson, Keith Kasnot, Chris Love, Emma Mullen, Jeff Osborn, Mary Swab, George Retseck, Jennifer Sugden, Tami Tolpa

CULINARY RESEARCH AND DEVELOPMENT

The chefs on our culinary development team were instrumental in the food photography. They conducted experiments, tested recipes from other chefs, and helped create all the original recipes in these volumes, which reflect their diverse backgrounds and distinctive experiences.

Andrei Modoran

Originally educated in Bucharest in physics and optics, Dr. Modoran obtained an MBA and a Ph.D. in physics from The Ohio State University before joining Intellectual Ventures in 2007 as an applied mathematician. He assisted with computer modeling and graphing for the book.

Grant Lee Crilly

Mr. Crilly practiced butchery at Bajon Jean Pierrie in Paris and completed *stages* at L'Astrance and with Pierré Herme's team at Grégoire-Ferrandi. He worked as *chef de cuisine* at Busaba in Mumbai and at Mistral in Seattle and served as head development chef at Delicious Planet in Seattle.

Samuel Velasco

Owner and lead designer at 5W Infographics in New York, Samuel Velasco has contributed illustrations to *National Geographic, Scientific American,* and other science and technology publications, as well as to this book.

Sam Fahey-Burke

Trained at the Culinary Institute of America, Mr. Fahey-Burke has held positions at The Fat Duck in Bray, England, Coi in San Francisco, and FiftyThree in Singapore.

Christina Miller

Ms. Miller studied biology and physiology at the University of Washington. She experimented on the physical and chemical properties of food for the book. She also helped summarize active research in food science.

Other culinary researchers

Grace Lowry, Kyle Bentley

Anjana Shanker

Ms. Shanker has a bachelor's degree from the University of Madras, India, and graduated with honors from Le Cordon Bleu College of Culinary Arts in Scottsdale, Arizona. Her culinary training began at Mary Elaine's, Arizona, and Lamperia, Seattle.

Johnny Zhu

Mr. Zhu is a graduate of Reed College and an alumnus of such notable restaurants as Jean-Georges, Spice Market, and Alinea.

BUSINESS DEVELOPMENT AND PROJECT MANAGEMENT

Daniel McCoy

Before joining the editorial team at Intellectual Ventures in 2007, Daniel McCoy was a neuroimaging research associate for the University of California, San Francisco. He managed a variety of daily operations related to the book in addition to contributing research and writing.

Bruce Harris

Bruce Harris is a publishing consultant who previously worked as a publisher for Random House, Crown, and Workman Books. Mr. Harris has published many cookbooks including *Larousse Gastronomique* and *Martha Stewart's Entertaining*, and he is helping to market and distribute *Modernist Cuisine* around the world.

Carrie Bachman

A cookbook and lifestyle publicist for almost 20 years, Ms. Bachman worked for HarperCollins as director of cookbook and lifestyle publicity before opening her own agency. Ms. Bachman's clients include noted chefs and cookbook authors Ina Garten, Mario Batali, Emeril Lagasse, Rachael Ray, Alice Waters, and Julia Child.

Mark Pearson

The founding publisher of Pear Press, Mr. Pearson got his start in publishing by creating the *Europe from a Backpack* series of travel books. The latest book, *John Medina's Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School,* is a *New York Times* best seller.

EXPERT REVIEWERS

Ferran Adrià
(see page 1·33)

After beginning as a dishwasher in 1980, Mr. Adrià rose rapidly through the ranks to become a world leader in Modernist cuisine. He is head chef at elBulli in Roses, Spain, where his culinary experiments enthrall diners from all over the world nightly.

Heston Blumenthal
(see page 1·49)

Owner and chef of The Fat Duck in Bray, England, Mr. Blumenthal made his name by taking an analytical approach to kitchen chemistry. Having published four books, including *The Big Fat Duck Cook Book,* he is a proponent of slow, low-temperature cooking and is known for experimental signature dishes like Bacon and Egg Ice Cream.

Kyle Connaughton

A graduate of the California School of Culinary Arts, Mr. Connaughton has worked in prestigious Los Angeles restaurants such as Campanile and The Water Grill, as well as in Japan with Michel Bras and others. Mr. Connaughton was head of development at The Fat Duck and now teaches at the Culinary Institute of America, in California.

Srinivasan Damodaran

With a Ph.D. in food chemistry from Cornell University, Dr. Damodaran has published extensively on protein-based polymers and enzymatic protein-based modifiers. He is currently a Winters-Bascom professor of food chemistry at the University of Wisconsin.

Eric Dickinson

Professor of food colloids at the University of Leeds, England, Dr. Dickinson worked in several postdoctoral placements after completing his studies at the University of Sheffield. He has authored several books, including *An Introduction to Food Colloids.* Dr. Dickinson's research interests include dairy proteins, rheology, and protein-polysaccharide complexes.

Wylie Dufresne

Trained at the French Culinary Institute in New York, Mr. Dufresne started wd~50 in Manhattan with chef Jean-Georges Vongerichten and restaurateur Phil Suarez. Nominated for multiple James Beard Awards, wd~50 was given three stars by *The New York Times,* and in 2006 it received one Michelin star. *Restaurant Magazine* included wd~50 on its Fifty Best Restaurants lists in 2005 and 2010.

James Hoffman

The director and co-owner of Square Mile Coffee Roasters and Penny University Café in London, James Hoffman was the U.K. Barista Champion in 2006 and 2007 and the World Barista Champion in 2007.

Harold McGee
(see page 1·43)

Dr. McGee is the author of *On Food and Cooking,* a bestselling book on the science of cooking that was named best food reference of 2004 by the James Beard Foundation and the International Association of Culinary Professionals. Mr. McGee has written for *Nature, Physics Today, Food & Wine,* and *Fine Cooking.* He writes a monthly column, "The Curious Cook," for *The New York Times.*

Donald Mottram

Dr. Mottram is a professor of food chemistry at the University of Leeds, England, and is a recognized leader in flavor research. His research focuses on the biochemistry of flavor formation, the Maillard reaction, the chemistry of meat flavor, and components of taste in fruits and vegetables. He made important contributions to the understanding of acrylamide formation in heated foods.

Joan Roca

Born in Girona, Spain, Mr. Roca was trained at the *Escola d'Hosteleria de Girona,* and since 1986 with his two brothers has run their restaurant El Celler de Can Roca, recently recognized with a third Michelin star. All three brothers received Best Chef, Best Pastry Chef, and Best Sommelier awards from the Academia Española Nacional de Gastronomía.

Ted Russin

An applications food scientist at CP Kelco in San Diego, Dr. Russin holds degrees in philosophy, food science, and food chemistry. As a consultant on hydrocolloids, he has worked with many influential chefs including Thomas Keller, Corey Lee, Adrian Vasquez, and Wylie Dufresne.

Jeffrey Steingarten
(see page 1·65)

Leading food critic at *Vogue* magazine since 1989 and the recipient of many James Beard Awards, Mr. Steingarten has published in *The New York Times* and *Slate* magazine. He is the author of the books *The Man Who Ate Everything* and *It Must've Been Something I Ate.*

Cesar Vega

A food applications scientist at Mars, Inc., Mr. Vega is an expert in dairy science, particularly ice cream and spray-dried milk products. He is coauthor of "Molecular gastronomy: A food fad or science supporting innovative cuisine?" and editor-in-chief of *The Kitchen as a Laboratory: Science Reflections Inspired by the Kitchen.*

David Julian McClements

A professor of food science at the University of Massachusetts, Dr. McClements has published more than 350 papers and written or edited seven books on food biopolymers and colloids. He has received awards for his research from the American Chemical Society, Institute of Food Technologists, and American Chemical Society.

ACKNOWLEDGMENTS

The authors would like to acknowledge the generous contributions of the many companies and individuals who supported the three-year effort to create this book. In addition to those mentioned in the contributors section above, we benefited from the expertise, advice, material support, and valuable assistance of the people and companies listed here. Of course, any errors that remain in the final product are the responsibility of the authors alone.

Individuals Providing Expertise and Advice

We benefited greatly from the technical experience and business or creative counsel of these people.

Shelby Barnes
Linda Bellekom-Allen
Francois Benzi
Anthony Blake
John Bove
Jean-Paul Carmona
Janet Carver
David Chang
Pamela Chirls
Kim Christiansen
Ron Crawford
Daniel Halpern
Amy Hatch
Gary Hawkey
Perry Hook
David Kinch
Jack Knight
Chuck Lambert
David Ledward
Claudia Leschuck
Ed Marquand
Jon McWhirter
Daniel Patterson
Stephanie Pretesacque
Howard Swatland
Hervé This
Adrian Villarreal
Julian Vincent
Carrie Wicks
Art Wolfe

Companies Providing Equipment and Supplies

Materials support in the research and photography involved in the creation of the book were graciously provided by these firms.

AccuTemp
Corfini
Eades Appliance Technology
Genevac
Monsoon restaurant
PolyScience
Red Arrow
Synesso
Victrola
Winston Industries

Individuals Providing Other Valuable Assistance

The people below helped in a variety of ways to complete the book.

Eric Bahn
Mark Barnett
David Burton
Leo Chou
Dana Cree
James Currier
Robert Darrington
Geoff Deane
Sarah Jane Hoope
Eric Johanson
Shieng Liu
Chris Love
Jeff Mahin
Brian McCracken
Don Moore
Nathan Pegram
Sandy Schneiter
Tracy Smaciarz
Kathleen Starks
Dana Tough
Kenny Walpole
Ian Whitehall

Colophon

This first edition of
Modernist Cuisine: The Art and Science of Cooking
was printed by Shenzhen Artron Color Printing Co., Ltd. of Shenzhen, China.
Prepress by iocolor, LLC of Seattle, Washington.
Design by Modernist Cuisine, LLC of Bellevue, Washington.
Published by The Cooking Lab, LLC of Bellevue, Washington.
http://modernistcuisine.com

Printed using stochastic color separation and Chroma Centric inks
on Oji matte art paper. Typefaces used include Arno Pro,
Optima Nova, Whitney, and Square 721.

PARAMETRIC RECIPE TABLES

Best Bets for

STRATEGIES TABLES

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Blueberries

Blueberries