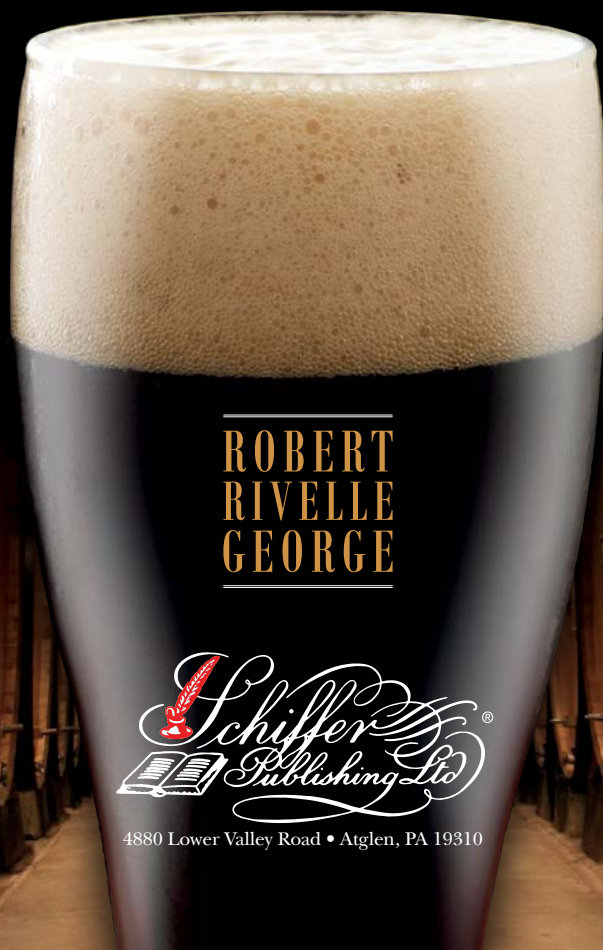




the **UMAMI** factor

Full-Spectrum **Fermentation** for the 21st Century



ROBERT
RIVELLE
GEORGE



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Dedication

To my sister, Elizabeth George, whose inspiring commitment to authorship, and subtle threats of bodily harm, drove me forward in times of doubt. And to Romalita, who didn't want to jinx the deal by expressing too much enthusiasm.

“If I have seen further, it is by standing on the shoulders of giants.”

— Sir Isaac Newton

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PREFACE

I love to relax with a good beer. There's something about that flavor. When I was in school, I thought I didn't like beer. It turns out that I didn't like mainstream commercial American beers.

A few years later, four buddies and I took a backpacking trip over the local 2,500-foot mountain, down into the canyon beyond.

We reached our camp physically destroyed, but since we'd managed to score some half-quarts of the new Schlitz Draft for the trip, we put those big boys in the creek to cool down.

Five minutes later, I popped a top and took a huge slug. Man, that was good...

Suddenly, it became clear why I had made that grueling trip. To understand just how cold and refreshing a beer can be!

What an amazing revelation.

At that time, there were even more exotic choices to be had—albeit at a price. There was San Miguel Dark from the Philippines. Dos Equis with its heavy lead neck sleeve. Deep, dark, delicious, yet mysterious Guinness. German-made Lowenbrau! But wow, they were expensive. What's a college student to do?

I chose to brew some beer. That was in 1973, and it was illegal. Luckily, the first batch I brewed was delicious. That too was a revelation; at first, I was concerned because my beer didn't taste like the beer I was used to.

Turns out, that's what beer is supposed to taste like. Rich and interesting. Rounded and balanced. Full of lots of different, intriguing tastes, aromas, and textures.

In the early 1980s, beers began to appear on the market that tasted very much like my home-brewed versions did. These were microbrews, and they were expensive, too!

So I decided to see how far I could take this interestingly, intricately poised flavor challenge.

Think of one of those rock-balancing feats you sometimes see on the beach. It's the same thing. The beverage, in this case, has an actual, multi-dimensional shape.

Round, yet delicately balanced. Not like a basketball on the court floor. Complex. Interesting. Intriguing in a "how'd they do that?" kind of way.

Over the years, I figured out how to create this eccentrically-balanced act that is full-spectrum fermentation, and it uses the umami sensation to build improbably delicious beverages.



The asymmetry of some of these beverages (hop-forward, malt forward, residual sweetness, etc.) makes them even more interesting. They may be asymmetrical, but they are still balanced; high bitterness balanced by round fruitiness in a Double India Pale Ale, for example. The taste and aroma stimulate the mouth, nose, and throat in an intriguing way. Building these experiences uses the umami factor in full-spectrum fermentation.

Figure P.1: Rock counter-balancing creates improbable structures that are nonetheless certainly possible. By Leandro Inocencio (Own work) [CC-BY-SA-3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>)], via Wikimedia Commons



FOREWORD

Robert Rivelle George is a brewer's brewer. His mission is to save fellow brewers from banality, from accepting the run of the mill. He strives to enlighten us about another level of excellence wherein the Japanese concept of Umami resides. Umami, the fifth taste, creates a complex impression that plays simultaneously on the other tastes. Umami is a recognition of symphonic taste sensations played upon many gradations, many shadings of flavor that contribute to the whole flavor experience.

Robert talks not only to aficionados, but starts off by showing new brewers how to achieve more complex results. His methods are straightforward and serve as a reminder to all practitioners. Robert's lists are exhaustive and crop up all over the book. Tables of hops, grains, adjunct additives, and yeasts, all promote one vision: how will they influence *The Umami Factor*?

But—and it is a large but—there is another vision present in this book. This is the vision of the brewer as fermentation chef or artist. This broadens the scope of the book considerably. Brewers will learn how to brew *sake*, fruit wines, mead, kombucha, ginger beer, and soft drinks from all corners of the globe. Robert also includes instructions on how to experiment in the world of distilled beverages! His book is an encouragement to create your own recipes too.

Robert does not lack bravery. He examines the spectrum of inebriation and its effects. He frankly looks at the world of other mind-altering substances and notes their historical benefits and warns of excess.

No reviewer of *The Umami Factor* can forget to shout from the rooftops that Mr. George's recipes are worth the price of admission alone. These are the creations of a man who is a master of his craft. Read this book carefully and keep it by you. You will be a better fermentation artist as a result.

Norm Chapman,
Brewmaster, Spencer Hill Cottage Brewery



INTRODUCTION

What makes life so fascinating is the depth and detail of the experience. There are certain aspects of life that can be profoundly interesting if one is immersed ever more deeply into the minutiae of the pattern.

The art of creative inebriation, a means of focusing the attention on transcendence of the ordinary while marveling at the complexity and depth of the experience, can be one of those infatuations.

Fermented beverages are one of man's loving inventions. In fact, for most of the time fermenting has been practiced, it has been a woman's loving invention. Today, it can be a nicely balanced interplay of yin and yang, of active and receptive principles. A balancing act, if you will.

Creating a successfully balanced transcendent feeling together with an all-encompassing flavorful impact requires a clear vision of the endpoint from the beginning: a detailed mental picture of what an artist intends to create in such a gustatory occurrence.

To achieve this clarity of vision, the creator benefits from either long experience, or at least a well thought-out theory of how the elements combine to create the desired vision.

When we study the characteristics of the winning recipes in fermentation competitions, one thing stands out: most of them use a whole lot of different ingredients.

These multiple flavor sources contribute a wide spectrum of sensations that crash across the palate in a wild symphonic statement: the statement made by the Umami Factor.

How can one achieve such virtuoso fermentation performances without years of experimentation? This book lays out in clear terms the theory behind creating these taste sensations: Full-Spectrum Fermentation.

The objective of a full-spectrum fermentation is to present a beverage to the imbiber that is balanced and "round," but not boring—in a word: improbable!

But undeniably possible, for—here it is!

Taste buds all over the mouth and right down to the stomach detect umami, regardless of where they are located. That is the secret of umami's full, round spectrum. It invokes its fulfilling sensation within the entire gustatory tract.

It seems a prudent use of what limited fermentation time one may have nowadays for making complex, high-gravity beers. They are by nature not "quaffable" in the common sense, so they last longer. These, however, are also beers that you will want to save and share. You can win competitions with them and enliven special occasions.

They are beverages wherein the time invested is much longer than a couple of hours to craft up an organoleptic extravaganza that engages sight, smell, taste, and touch in a fully rounded, high-amplitude experience. It's frankly a lot of work to create many of these drinks: often 12 hours on brew day, with perhaps more than six months of aging before, and conditioning after bottling.

Still, it is also possible to create a custom-made beer that is “quaffable” and much sooner consumable while retaining the full-spectrum characteristic. By tweaking the standard recipes to be found from many sources, the brewing artist can produce beers that fulfill the promise of highly complex, deeply original, yet extraordinarily satisfying flavor experiences.

The key is to keep in mind the Umami Factor and create a fermentation idea that is complex enough to surprise the expectations of the palate while considering the time restraints at hand. This book offers suggestions that comply with both ends of the time spectrum.

Here is where the concept of full-spectrum fermentation comes into play. Using a technique of flavor component selection and complete understanding of flavor perception, the umami artist can be confident in bringing to life an inner vision and the relaxed savoring of a job well done.

Figure I.1: The ingredients of fermented beverages combine in harmonious ways to produce a full-spectrum flavor experience.
Bigstock photo



Chapter 1 SPECTRAL BALANCE

What is a spectrum?

Spectrum is a Latin word meaning “image” and even “apparition.” Sir Isaac Newton was the first scientist to use the word spectrum to describe the rainbow of colors that appeared when visible light passed through a prism.

Our interest in the concept of spectra—with regards to fermentation—also includes the meaning that refers to “spiritually inspired renderings.” But the idea of a spectrum is also fully tied to the real world, in the sense that it describes a signal that can be measured along a continuous variable, like the “light spectrum.” There is no distinct demarcation between the colors of this spectrum; rather, they blend gradually from one to the next.

In today’s usage, a spectrum can refer to any occurrence that contains a unifying theme between extremes at either end. In this sense, fermentations can also be described as several interacting occurrences (properties) that can each be measured along varying degrees of a continuum, and which together form an experience we call beer, wine, mead, cider, or liquor. We’ll talk about these various properties later, but first:

What is a full spectrum?

A spectrum is a variable that is not limited to a specific set of values, but can vary infinitely along a *continuum* of values within a common theme. The word “continuum” describes the variation of a quality through a gradual transition, without abrupt changes or discontinuities.

A *full spectrum* is one that contains all of the possible values within the range of perception. White light is a full-spectrum occurrence because it contains all the values of the visible light spectrum in equal amounts.

But with regard to fermentation, it is the “image” or “apparition” meaning that is most important. The act of *visualizing* the interaction between different full spectra for several continua at once becomes an act of creation ultimately experienced by the consumer as an overwhelming harmonious whole.

This does not suggest that, as with white light, *all* of the values are present in equal quantities in all the spectra that form the experience of a good fermented beverage, but all of them are nonetheless there to one extent or another if it is to be called full-spectrum.



Figure 1.1: The visible spectrum shows smooth transitions from one color to the next. Public domain via Wikimedia Commons

What does it mean to have spectral balance?

Let's break the question down so that a single spectrum is analyzed as to what it means to have spectral balance. Consider the black and white photograph. The trick to making photographs render a vivid sense of reality in black and white, is to make sure that a print presents a full visual world that includes a complete range of tones from pure white to pure black.



Figure 1.2: A full-spectrum gray scale contains tones from pure white to pure black. By Tomás Castelazo (Own work) [CC-BY-SA-2.5 (<http://creativecommons.org/licenses/by-sa/2.5/>)], via Wikimedia Commons

Photographer Ansel Adams was able to achieve a “full-spectrum” effect in black and white format. If you look at one of his prints, it is easy to see that every gradation of brightness, from pure white to total black, is represented somewhere in the photo. He did this using the “zone system,” in which he exposed negatives by underexposing or overexposing certain areas, and produced prints by “dodging and burning” the print with movable masks above the photo paper.

Ansel Adams broke the continuum of light into eleven “average” values within the range. He distinguished a “textural range” among these that conveyed a sense of structure and substance within the image. He also developed a technique of exposure and manipulation of the photographic materials that ensured that all eleven values were represented somewhere in the image, no matter how minutely. The photographer creates a sense of reality by providing a balanced visual experience.

Similarly, we can use a “zone system” when we construct a beverage. We can imagine this, for example, to consist of:

Strength of flavor = brightness
Variety of flavors = contrast

Seek a balance of brightness and contrast in a beverage and it will be a “full-spectrum” experience.

Or consider an auditory example of spectral balance. Recall the combined aural spectra of the 100-odd instruments in a symphony orchestra, all performing at the same time, yet completely avoiding a noisy chaos. The composer has visualized a complete aural field, which creates “shaped” air pressure waves that we find very pleasing. Contrast this with what

you might imagine a chorus of 100 banjos playing in unison might sound like rendering *Oh Susannah!* Harsh and monotonous? How many times would you like to hear that? How many times would you like to hear Scheherazade?

How does this apply to fermentation?

This is where the concept of the palette meets the concept of the palate.

We can speak of a palette—a selection of various spectra—as the working materials artists believe they will need to complete a picture representing the artistic vision they have.

Successful artistic visions are often described in terms of how their visual “balance” in terms of color, object placement, and texture impacts the recipient.

A fermentation that has spectral balance is one within which the several interacting, full experiential spectra exist in a harmonious blend. In music, this is expressed as point and counterpoint, much as the instruments of a symphony each contribute to the blend within the range of their physical limits. In fermentation, this is achieved with the skillful balancing of the range of ingredients available to create a beverage.

Think of the strength of a flavor as “brightness” in a photo and the variety of flavors as “contrast.” The fermentationist seeks a balance of brightness and contrast the way a photographer does.



Figure 1.3: Fermented beverages create a full-spectrum impact of sight, smell, and sound.

What are the spectral elements of a fermented product?

In fermentation experiments, several spectra exist that the creator can manipulate to achieve balance among more than just one spectrum simultaneously. Most obviously, these elements include:

Color

Visual impact

Aroma

Taste

Mouth feel

Aftertaste

Effect

Consider these spectral elements. Each consists of an infinite series of variations along the continuing themes referred to above. To say more about each one specifically:

Color

Beer starts out at the pale, even at the clear and transparent end of the spectrum (think Coors, Zima) and progresses through yellow to gold, amber, red, ruby, and brown, and on to black.

Visual impact

Beer can be as insipid and unlively as a pale, cheap, canned lager, or it can show sparkle, creaminess in the head, lace, vibrancy, chromatic highlights, or visual richness through varying degrees of transparency to opacity.

Aroma

Aroma can range from practically nothing to slight maltiness or hoppiness, to varying intensities along each scale, including caramelly, toasty, or roasted odors and floral, piney, or citrus notes.

Taste

Sticking with the insipidness of a canned industrial lager beer as a proxy for “pure white,” fermentation tastes can have a number of sub-spectra that include sensations of sweetness, saltiness, bitterness, sourness, and savoriness that can vary from merely suggestive to wildly indulgent—as many Belgian specialties can be.

Mouth feel

Light and watery though a diet beer may be, the range of sensations of fullness or heaviness in texture progress through varying degrees of final gravity to end among the mouth-filling abilities of Imperial Stouts and Barley Wines. The perception of mouth feel is also influenced by the serving temperature of the beverage. Cool or cellar temperature drinks may feel heavier than very cold ones, though in fact their specific gravity may be lighter.

Aftertaste

The ingredients of beer tend to linger in the mouth, and the aromas tend to be exhaled for several breaths afterward. These sensations may be negligible, or they may exhibit varying degrees of sweet or cloying, dry and sharp, tangy, sour, or astringent sensations.

Effect

That fermented beverages provide a desired inebriating effect is obvious, but the other ingredients can be manipulated to move this effect along a spectrum as well. The inebriation spectrum ranges in two directions from a generally accepted sense of “normality”: in one direction—let us say to the “left” of normality—perception ranges from mild relaxation to deep meditation.

Often the criteria for a drink are measured by its “quaffability”—the ability to be tolerated in large quantities both in taste and intoxicating strength. Alcohol can provide a sedative effect, resulting, upon increased dosages, in unconsciousness and death. So, while quaffability is a useful measure of effect, high-alcohol beverages—while perhaps not considered “quaffable” in the common sense—can also be spectrally complete. They just must be quaffed in smaller quantities.

Alternately, the fermentationist can rely on herbs instead of alcohol for a relaxing effect, with no chance of ethanol poisoning. Skullcap, passion flower, and kava kava are examples.

Toward the “right” side of the effect spectrum lie increased alertness and concentration, agitation, imagination, and finally ecstasy. In this direction, herbal extracts are the contributors to the effect, not the alcohol. The herbs used in Medieval ale, called Gruit, have various stimulating effects ranging from alert to ecstatic. Alertness and stimulation can be achieved with herbs such as marsh rosemary and sweet gale. Mandrake and henbane provide a wild ecstatic ride that is not recommended without the assistance of a shaman, as the imbiber loses all ego feedback function.

The spectral components of flavor

The sensation of flavor is a combination of impressions received by our senses of taste and smell, and probably the thing we think of most when we consider how much we like a fermented product.

There are additional components in how humans experience their consumptive habits, including palatability (texture, temperature, visual impact, sound) and acceptability (environment, cultural expectations, personal mood). Together, this multi-dimensional spectral manifestation creates the sensation that a flavor has a “shape.”

Flavor science recognizes the “amplitude” of flavors as being a function of balance. Flavors that are well balanced are said to have high amplitude. It is this characteristic, or essentially impact, that provides the sensation of a satisfying experience. Coca Cola® is a very “balanced” beverage, which is a key to its

success. This can be demonstrated easily by taste testing Coke against two or three low-priced cola beverages. Flavor imbalances such as “too much cinnamon” or “too watery” are readily evident.

But first, let’s examine the more commonly understood components of a flavor experience: taste and aroma.

Taste Spectrum

The *taste* of a beverage comprises five elements—yes, five. In addition to the four well known sensations of sweet, sour, salty, and bitter, our taste sensors are also sensitive to an impression of *savoriness*, called *umami* by its discoverer, Japanese food scientist Kikunae Ikeda of Tokyo Imperial University.

Considering all five of these elements, we find:

Sweetness signals our bodies that a food or beverage is high in energy value, in this case simple carbohydrates that are essential to our survival. Such sweetness is highly attractive to many animals, which seek it out for the striking sense of fullness it provides. Sweetness by itself, however, can become cloying and overpowering, as when indulgence in too many sodas and candy bars leads to a queasy feeling. Sweetness in a fermented beverage is a result of residual organic constituents remaining after the drink’s manufacture, primarily due to the limit of the yeast strain’s tolerance for alcohol. Alcohol is poisonous after all, and too much kills the yeast. The liquid may also contain more complex sugars such as dextrins, which are not fermentable by most commercially cultivated yeast (though wild yeast may be able to do so).

Sourness contributes piquancy and tanginess to the world of taste. While sourness is usually a defect, it is desired for particular styles of fermented beverages. Sourness is experiencing a revival of interest, not in the form of the acetic acid of malt vinegar that we sprinkle on our chips, but in the mellower lactic acid of lambic and other specialty beers. It comes from the effect of *Lactobacillus*



Figure 1.4: Pizza is loaded with umami ingredients: tomatoes, mushrooms, meat, and parmesan cheese. Five taste sensations combine to produce a mouth filling experience.

inoculation, or occasionally, the addition of acidic juices. Because the growth of the organisms responsible for sourness in fermentations can be hard to control, sourness in most other fermentations is considered a fault.

Bitterness is usually associated with things that are bad for us—dangerous plants or foul waters, for example. But in the realm of fermented beverages, bitterness is the astringent bite that offsets other sensations, particularly that of sweetness, adding balance and enjoyment to the experience. Citrus peel, coffee, chocolate, herbs, and spices contribute to the sensation of bitter taste in full-spectrum fermentations. In particular, hops are the primary source of bitter sensation in beer. Tannin from grain husks or fruit skins can contribute a sense of bitterness as well.

Saltiness—how does one describe this very familiar taste that signals the presence of certain vital dietary minerals? Somewhat biting, mouth-watering, metallic—minerally! These words attempt to characterize something that everyone immediately recognizes as “salty” with little more description required. Salts are mineral compounds that result from the neutralization of an acid with

a base. They provide elemental ions that help the body regulate and moderate metabolic activity. In very small amounts, salt ions contribute to the sensation of roundness and fullness in the flavor of a beverage, without ever reaching a level where the taste can be described as “salty.” Interestingly, different types of mineral salts can stimulate each of the five taste sensors in the digestive system. In the context of fermentation, we are interested primarily in the salts sodium chloride, calcium chloride, calcium sulfate, magnesium sulfate, and monosodium glutamate. In solution with water, salts dissociate into their constituent elements to become free-floating ionic (electrically charged) atoms or compounds of metals, nonmetals, and gases. Many of these ions are crucial to the brewing reaction itself, contributing to the acid balance of grain mashes and fruit extractions. These different ions also react with our taste buds in different ways, adding emphasis to the sensations arising from the other ingredients: carbohydrates, herbs, and microorganisms. Salty flavor in a fermented beverage should be confined to a sensation in the extreme background. Sodium chloride—table salt—is the usual source, typically

in quantities of less than 0.1 gram per liter. If table salt is used, it should not be iodized, to avoid interfering with yeast health. Additional complexity of flavor can be achieved by using grey sea salt. The best is produced in Brittany from North Sea water, and contains minerals derived from the clay-lined ponds in Guérande from which it is evaporated. Magnesium, Calcium, and Sulfates are the most significant of these. Arsenic, Cadmium, Lead, Nickel, and Mercury are notably absent. The highest grade of sea salt is the fluffy “fleur de sel” that is hand-collected from the top of the salt pans before it sinks to the bottom and picks up impurities. Because it forms under only certain weather conditions, it is rare and consequently, expensive. Sprinkle it on your steak and use crystals of grey salt in fermentations.

Umaminess—formally described only about 100 years ago—the taste umami (Japanese for “delicious”) is now accepted as a real sensation, with identified receptors among the taste buds of the digestive tract. Whereas the sensors for the first four tastes are concentrated in certain areas of the mouth and tongue, umami sensors are distributed throughout the mouth. This gives foods high in umami a perception of fullness or roundness of flavor, as well as savoriness. Proteins in the yeast and grains and, to the extent they are present in your fermentation, fruits or vegetables, provide the glutamates and nucleotides that provide the Umami contribution.

Recent science has even discovered umami receptors in the stomach! That’s full-spectrum! Umami is a taste that for centuries has been “hidden in plain sight.”

The compounds humans detect as umami are glutamates and nucleotides. These compounds create a sensation of savoriness in the mouth often associated with chicken broth. But aside from the well-documented ancient recipe for “Cock Ale,” how does one account for a *savory* fermented beverage?

Glutamic acid is the most common amino acid ingredient in eating and drinking substances. It is essential to neural functioning and ubiquitous in our experience of satisfaction. When glutamate

molecules break apart through ripening, cooking, fermentation, or aging, L-glutamate is formed. That’s when things get really delicious.

The umami flavor of fermentations comes from naturally occurring glutamates in the grain, yeast, and fruit ingredients. These provide a deeply satisfying, full-mouth demonstration of generous satiation that is the crux of the Umami Factor.

Speaking of glutamates, though, these compounds have gotten a bad reputation over the last 30 years. Monosodium glutamate (MSG) in particular has become something of a bugbear among consumers. In fact, glutamates exist naturally in a wide variety of foods. A “non-essential amino acid,” they are synthesized by the human body as an important neurotransmitter.

Though the existence of the so-called “Chinese Restaurant Syndrome” associated with MSG remains totally unproven, be assured that full-spectrum fermentation requires none of this artificial compound. In beer, umami comes primarily from two natural sources.

First, barley malt has considerable protein in it (in the range of 10% to 15%), and the largest component of this is glutamic acid. The processes required to turn barley into beer involve reactions that convert this to glutamates. Most importantly, though, is the contribution of the yeast. Nutritional yeast, known for its nutty, creamy flavors, provides a sample of this flavor. Residual yeast in non-filtered beer creates umami.

Aroma Spectrum

The most prominent among the aromas wafting from a fermented beverage are those that arise from the herbal component of its recipe. In addition, and sometimes dominating, *malts* contribute grainy-sweet aromatics, *fruits* contribute their distinctive smells, and *yeasts* offer crispness and fruitiness.



Figure 1.5: Aromatic compounds in herbs and other ingredients combine with their tastes to create the impression of “flavor.”

Hop Aromas

From their origin in ancient China, hops have blossomed forth in an increasing number of varieties from which have been teased an astonishing spectrum of hoppy aromas. At least eighty strains yield aromas ranging from resinous (conifer, licorice, pine needles) through spicy (cinnamon, nutmeg, pepper) and fruity (apple, apricots, berries, melons, peaches, pears, grapefruit, lime zest), to tea-like and flowery (anise, gardenia, orange.)

American hop varieties are the most numerous. In the years since 1990, American hop cultivation has exploded, first creating high-bitterness hops, and recently concentrating on developing strains that provide intense aromas, such as citrus fruit.

Among *English* varieties—the next most common—a taster finds earthier, woody aromas, along with the tendency to be from somewhat to quite-a-bit less bitter.

Continental Europe is the source of twenty or so of the lighter, less bitter hop varieties. These are useful in brewing the crisp lagers typically brought to mind (and lip) there. Europe is particularly well known as the home of the “Noble” hops of Germany and Bavaria.

Australia and *New Zealand* have proven they are exceptionally fertile hop territory and have begun to produce at least twenty varieties emphasizing the delicious tropical quality of the South Seas, including legendary guava and passion fruit nuances. And in *Japan* growers have brought out an interestingly unusual variety reminiscent of lemonade and bubblegum!

Wet-hopping—a recently rediscovered practice of adding fresh-picked hops to a batch without first drying them with warm streams of air—reveals an entirely new high-frequency spectral band of volatile aromatics that were previously best savored only at the exhaust stack of the local oast.

Malt aromas

Simple clean graininess—barley that has been sprouted and then gently dried has a distinct, clean, grainy aroma that sometimes reminds one of the smell of the malted milk powder of breakfast drinks or candy balls.

Biscuit and aromatic malts can add smells reminiscent of baked goods, like scones and cookies, or toasted bread.

Munich malts contribute a rich malt aroma. Vienna malt and crystal malts contribute a caramel-sweet aroma to the brew.

Darker grains provide aromas that resemble those of toffee, coffee, chocolate, or espresso.

Kilning “green malt” (sprouted, but not dried) over a fire of hard wood or peat will impart aromas from sweet to robust smokiness—recalling the smell of Scotch whisky or German Rauchbier.

Yeast aromas

The yeast contributes numerous aromas as it forms the byproducts of its fermentation and maturation. Many of yeast’s aromatic contributions are savory glutamic compounds.

The range of aromas can vary from crisply neutral, to fruity and estery, to pungent, and even odd. Good brewery sanitation tamps down most undesirable aromas: vinegary, cardboardy, or putrid. The rest are esteemed—often to great extremes by the community of yeast aficionados.

Most prominently, yeast produces the aroma of alcohol and the sharpness of carbon dioxide. In addition, yeast can create a number of compounds producing desirable or undesirable aromas of:

- green apples (acetaldehyde)
- butter or butterscotch (diacetyl)
- corn or cooked vegetables (dimethyl sulfide—also influenced by malt and mashing)
- cloves (eugenol acetate)
- bananas, strawberries, fruit (esters)
- medicines, plastics (phenols)
- solvents (acetone)
- rotten eggs (sulfides)

Talk about a range of aromas!

How does the full-spectrum fermentation concept apply to fermented beverages?

The American shopper is willing to pay \$3.99 for a jar of mustard instead of \$1.49, if what they buy includes a sense of sophistication and an experience of complex taste and aroma. Why? For its sophisticated roundness of flavor.

The application here to fermented beverages is to create complexity with balance. A wide variety of ingredients are applied in a well-thought-out manner to create a fully rounded and complete sensory experience—a multi-dimensional beverage, if you will.

This is not a new idea, but in modern commercial scale brewing it is impractical to provide the granularity of flavor variation resulting in a very round or balanced experience. But this is the key to the experience of home brewing, much as home baking or home cooking is. Homemade pasta sauce and artisan bread are two examples that are close to brewing in their complexity

and technique. They can be very complex and far better than commercially available examples.

So can crafted brew. The next chapters will discuss how the principles of full-spectrum fermentation are applied to create that sensory balance crucial to a memorable imbibing experience.



Figure 1.6: Artisanal mustard has a much more complex flavor, with ingredients such as wine and herbs.