

Umami

*If You've Got it, Flaunt it*

# Umami

## If You've Got it, Flaunt it

Sweet, salty, bitter, sour... four of the basic tastes sensed by specialized receptor cells on the human tongue. And then there's the lesser known fifth basic taste — umami. Derived from the Japanese word for *umai*, meaning delicious, umami (pronounced oo-MAH-mee) is variously translated as "savory," "brothy" or "meaty." To scientists, umami is the taste of many different amino acids, or the building blocks of protein. To chefs and food lovers, it's a sense of gustatory completeness, of balanced flavor, of the sum being more than the total of its parts. Foods that are rich in umami present not only full-bodied taste, but also qualities of aroma and mouthfeel that are immediately discernible.

Think of such wholly satisfying foods as steak and sautéed mushrooms, pepperoni pizza, Pad Thai, and pasta with tomato sauce and Parmesan. That's umami in action.

When you've experienced a true "u-bomb" — a burst of rich, savory flavor — you taste it. Fish sauce is full of umami. Aged cheese is packed with it. And mushrooms are rich in it.

Umami stimulates the appetite; it makes food taste good from first bite to last, and it helps to create satiation. "Thousands of chefs and serious cooks have embraced umami as an easy, dramatic way to make food taste better, by emphasizing umami's rich, meaty, savory qualities," says David Kasabian, who with his wife, Anna, is author of **The Fifth Taste: Cooking with Umami**. History indicates that people have been aware of umami's characteristics for thousands of years, yet it was only a few years ago that science confirmed its existence.

## A Little History

Cooks have understood the concept of umami for centuries, at even the most rudimentary and intuitive levels. According to Jacqueline B. Marcus, R.D., assistant professor and chair of the Culinary Nutrition Program at Kendall College, Chicago, fermented fish sauces and intense meat extracts — such as Greek and Roman garum, Thai nam pla, and British beef tea — have been valued in world cuisines for more than two millennia. Brillat-Savarin, writing in The Physiology of Taste in 1825, described in considerable detail the "toothsome" flavor of meat.

In 1908, a professor at Tokyo Imperial University named Kikunae Ikeda began experimenting with konbu, a type of dried seaweed used (along with dried bonito tuna flakes) to make dashi, the flavorful broth that characterizes many Japanese recipes. Dr. Ikeda had observed that there were many foods — including not only konbu and dashi but also asparagus, tomatoes, cheese and meat — that had a common taste, apart from the well-known sweet, sour, salty and bitter.

Ikeda was able to isolate this flavor in konbu broth by extracting crystals of glutamic acid, or glutamate, which had a distinctive taste that the professor christened umami. (The crystalline white substance on the surface of dried kelp is also glutamate.) He sold the patent for the resulting seasoning to Ajinomoto, a Japanese company that produces food seasonings, cooking oils, foods and pharmaceuticals, which brought the product to the United States in 1917 in the form of monosodium glutamate, or MSG.

It was not until 2000, however, that the presence of this fifth taste was confirmed by researchers at the University of Miami School of Medicine, who discovered taste receptors for umami. Subsequent research has uncovered a network of molecules and receptors that allows the brain to experience umami, working like a key in a lock to open the door to flavor.

The search is now on for receptors representing sweet, salty and the other basic tastes — in this regard, umami research has been instrumental in creating expanded interest in flavor science — and many experts believe other flavor mechanisms will eventually be discovered. Indeed, in November 2005 a team of French scientists found evidence for a sixth taste, for fatty substances, and some Japanese researchers refer to kokumi, which has been described as continuity, thickness and "mouthfulness."

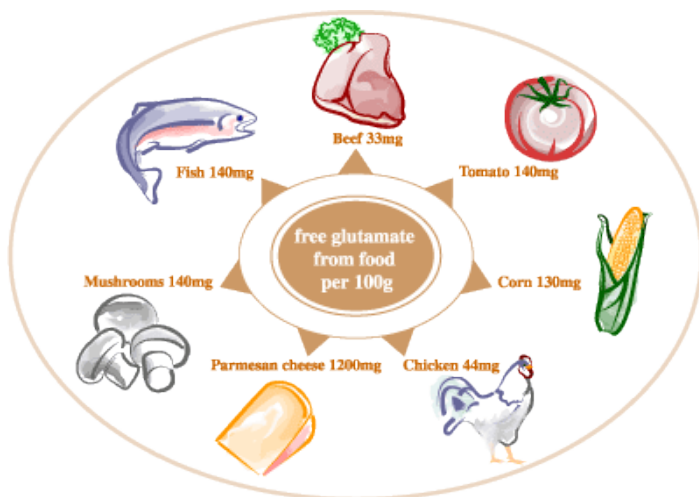
## A Bit of Science

The sense of taste is a biological necessity — indeed, all the senses are. The sensation of sweet is triggered by the presence of energy-giving carbohydrates, while salty indicates necessary minerals; both drive humans and other animals to seek these flavor experiences. Sour and bitter tend to occur with substances that are unripe, spoiled or poisonous; what is less well-understood is why so many humans have developed a liking for things like pickles and dandelion greens.

(A word about nomenclature: strictly speaking, "taste" is experienced only in the mouth, whereas the concept of "flavor" also includes aroma, or smell, and is perceived in the brain.)

At its most basic, umami is believed to drive the appetite for protein. Protein (from the Greek *protas*, meaning "of primary importance") is an organic compound that consists of amino acids joined by peptide bonds. Proteins are essential to the structure and function of all living cells, and they are broken down for the body's use in a variety of different ways, including digestion.

The most abundant amino acid in nature is glutamic acid, or glutamate, which is a key molecule in cellular metabolism; it exists in both the "free" form, in plant and animal tissues, as well as "bound" as part of a protein molecule with other amino acids. Free glutamate plays a role in palatability, and is naturally present in a number of foods, including mushrooms, aged cheese, tomatoes, meats fish and poultry.



Source: International Glutamate Organization

Umami is provided by IMP (inosine monophosphate) and GMP (guanosine monophosphate), acids naturally present in many protein-rich foods. Generally speaking, IMP is found primarily in meat and other animal proteins, whereas GMP is more abundant in plants.

Dried skipjack tuna flakes — the bonito used to make the Japanese broth dashi — is particularly rich in IMP, while dried shiitake mushrooms possess a very high concentration of GMP. The synergizing effect between MSG, IMP and GMP produces a strong umami taste in certain concentrations. Although the exact mechanism for this synergy is not yet known, according to Jacqueline Marcus at Kendall College, using a 50/50 blend of MSG and IMP, for example, can result in an eightfold increase in the umami-enhancing effect.

| Natural Sources of Glutamic Acid | Natural Sources IMP | Natural Sources GMP |
|----------------------------------|---------------------|---------------------|
| Kelp/Seaweed                     | Oysters             | Bonito              |
| Cheese                           | Duck                | Mackerel            |
| Green Tea                        | Soybeans            | Sardines            |
| Sardines                         | Chicken             | Tuna                |
| Fresh Tomato Juice               | Spinach             | Beef                |
| Peas                             | Carrots             | Prawns              |
| Corn                             | Mackerel            | Chicken             |
| Mushrooms                        | Beef                | Cod                 |
| Tomatoes                         | Beets               |                     |
| Potatoes                         | Milk                |                     |
| Chinese Cabbage                  |                     |                     |

It's no coincidence that dried tuna and dried mushrooms are so rich in umami. Natural processes used to create both, such as ripening, as well as drying, curing, aging and fermenting, serve to concentrate flavors by breaking down the protein molecules and liberating (freeing) the various components, including glutamic acid. These ancient methods of food preservation yield many of the foods that are so high in umami, such as cheese, cured meats, and fermented products like nam pla and Worcestershire Sauce (which contains anchovy).

The process of cooking also helps to break down food into smaller units of flavor, and here's where the fun starts.

## How Umami Works

As far as the cook is concerned, there are two forms of umami, "basic" and "synergizing." Many foods have both, in particular such high-protein foods as meat, milk, mushrooms and seafood.

Basic umami comes from amino acids, particularly glutamic acid, explains food expert David Kasabian, but it must be in the "free" form (the type found in plant or animal tissues) to provide its characteristic taste. In general, the more mature a food, the higher its level of free amino acids — thus the superior flavor of a tomato that has been allowed to fully ripen before harvesting.

Foods composed of "bound" amino acids (those that are part of a protein molecule with other amino acids), on the other hand, need to be coaxed a bit in order to emphasize the taste of umami. This can be accomplished through cooking, in which the heat breaks down the amino acids or through enzymatic action in the form of aging, curing and fermentation. Through these processes, the amino acids become more available for the body to use; the food also increases in umami. And, generally speaking, the more slowly you cook something, the more flavor it develops, including umami.

Foods that are already high in basic umami can get a flavor boost through either cooking or enzymatic action. Dry-aged steak, for instance, has more umami than ground beef; cook that steak and the umami sensation is multiplied. Likewise, sautéed mushrooms have more umami taste than raw mushrooms; as do dried.

Synergizing umami is delivered by nucleotides, chemical compounds that are the building blocks of RNA and DNA. Nucleotides, writes Kasabian, "are found in abundance in meats, shellfish and mushrooms. They too may be in free form or bound up in large, tasteless molecules. Like basic umami, synergizing umami is developed when these large molecules are broken down into their tasty free nucleotides by cooking and enzymatic action. We call this synergizing umami because both research and everyday experience have shown that when synergizing umami is eaten along with basic umami, the umami sensation is multiplied... knowing which foods contain which kind of umami and what state it is in can help you make meals that are more delicious."

## Why Umami is Important

The existence of umami and our understanding of how to manipulate it has a number of implications, not least of which is flavor enhancement. Simply stated, umami enhances gustatory satisfaction, creating both appetite appeal and satiety.

It's no secret to anyone in the food industry that MSG (monosodium glutamate) is a flavor additive found in a lot of the foods we eat — not just in Chinese restaurants, where the debate about MSG's safety began in the late 1960s — but also in many processed foods. Numerous studies have led the Food & Drug Administration to place MSG on the list of substances that are Generally Recognized as Safe (GRAS), a category that also includes salt, baking soda and vinegar. But, because umami packs the flavor that MSG does, chefs and food processors can now use all-natural ingredients to create flavorful dishes instead of MSG. With today's focus on clean ingredients and natural flavors, umami can be a powerful tool in the kitchen and on the bench.

The principles of umami can be used to enhance palatability, particularly in individuals who have experienced a decline in the ability to taste because of age, radiation treatments, or other health reasons. Properly used, umami highlights sweetness, lessens bitterness and counterbalances saltiness, and can contribute up to a 50 percent salt reduction without compromising desirability, according to Jacqueline Marcus. Recent research indicating that children who say they "hate" vegetables may be overly sensitive to bitter tastes, suggesting another possible role for umami.

Because it helps create satiety, chefs and food processors can use natural sources of umami when formulating foods with an eye toward reducing sodium and fat levels in the finished product.

From a purely competitive point of view, the proper handling of umami can create foods that consumers want to taste again and again. Cooking is a complex metric of art and science, and umami can be viewed as another tool in an arsenal that also includes many other aspects of technique and flavor.

## Umami and Mushrooms

As previously noted, mushrooms are a valuable source of both basic and synergizing umami. Although dried shiitakes represent the mother lode of mushroom-based umami, all mushrooms, as well as other fungi (including yeast!), contain umami.

Generally speaking, the darker the mushroom the more umami it contains. That puts shiitakes, portabellas, morels and porcini at the top of the list, followed by chanterelles, crimini and button mushrooms. In addition, dried mushrooms tend to have more umami than fresh ones, and cooked mushrooms are more umami-rich than raw.

Collectively speaking, this means that adding mushrooms in virtually any form — raw, sautéed, whole cap garnish, even a dusting of dried powder — will add an umami lift to foods.

## Building the “U-Bomb”

Bottom line, the more umami is present in food, the more flavorful it will be. That principle covers both the ingredients, and the cooking or handling processes that are applied. Broiled or grilled steak topped with sautéed mushrooms, for instance, represents an umami “three-fer”: Basic and synergizing umami are present in both the beef and the mushrooms, which are boosted through the cooking process. When this happens, the umami sensation — and thus the eating pleasure — is multiplied.

Perhaps nothing illustrates this so well as the following recipe, reprinted with permission from David Kasabian’s **The Fifth Taste: Cooking with Umami**. It demonstrates how combining a variety of umami-rich ingredients (indicated in boldface) and enhancing them through different cooking techniques creates a layered, nuanced eating experience.

The key is to use umami to help achieve balance. “Umami by itself is not such a big deal,” says Kasabian. “After all, if you put MSG on your tongue, all you get is a soapy or metallic sensation. But in combination with other ingredients and processes, umami makes everything taste better.”

## Coq au Vin Nouveau

From **The Fifth Taste: Cooking with Umami** by Anna Kasabian and David Kasabian (Universe, 2005). © 2005 Anna Kasabian and David Kasabian. Used with permission.

Serves 4 for dinner

At the risk of committing heresy, we present this quick and easy update to the venerable Burgundian (and very umami) classic that traditionally calls for bacon, red wine, and a tough old rooster. We have lightened it up with lean smoked ham and your choice of white wine; good matches, we think, for the lighter flavor of thighs from a younger chicken. Make it a day ahead and gently reheat it for even more umami and better-developed flavor. Keep a loaf of good French bread nearby, as the gravy is irresistible to sop up.

- 2   tablespoon extra-virgin olive oil
- 4   ounces lean smoked **ham**, diced medium
- 8   skinless **chicken thighs**  
    Salt and freshly ground black pepper
- 3   tablespoons all-purpose flour or Wondra
- 1   medium onion, diced medium
- 4   cloves garlic, minced
- 1/4 cup minced shallots
- 1   cup cremini or button **mushroom** slices, 1/4-inch thick  
    (1/3 to 1/2 pound)
- 1   cup fruity **white wine** such as Sauvignon blanc
- 1   (14-ounce) can low-fat **chicken broth**
- 2   medium **carrots**, peeled and sliced 1/2-inch thick
- 2   stalks celery, sliced 1/2-inch thick
- 2   sprigs fresh thyme, or 1/2 teaspoon dried

1. Choose a heavy Dutch oven or skillet with a tight-fitting cover, large enough to fit the chicken in no more than two layers plus the vegetables. In this pan, heat 1 tablespoon of the oil, add the ham and sauté until browned all over. Remove and reserve the ham, leaving as much of the oil in the pan as you can.

2. Liberally season the pieces of chicken with salt and pepper and dredge them in the flour. Add the remaining oil to pan. When the oil is hot, sear the pieces of chicken thoroughly on all sides until well browned. Take care not to scorch the flour coating, but do let it get brown. Do this in batches. Reserve the chicken with the ham.

3. Return pan to the burner set to medium. Add the onion, garlic, shallots, and mushrooms, and sauté for 3 minutes, stirring constantly, until tender and fragrant. Add the wine, chicken broth, carrots, celery, and thyme, and let the pan come to a boil. Add the reserved chicken and ham. Cover the pot and bring to a simmer. Cook for 45 to 50 minutes, until the chicken is very tender and the sauce has thickened from the flour. Taste and correct seasoning with salt and pepper.

4. Arrange chicken pieces and vegetables on a warmed platter, and cover with the sauce. Serve with rice, noodles, or roasted potatoes.

### **Additional References/Resources:**

**The Fifth Taste: Cooking with Umami**, by David Kasabian & Anna Kasabian  
[www.the-fifth-taste.com](http://www.the-fifth-taste.com)

**Umami Information Center**, [www.umamiinfo.com](http://www.umamiinfo.com)

**Research Chefs Association**, [www.culinology.org](http://www.culinology.org)

**International Glutamate Information Service**, [www.glutamate.org](http://www.glutamate.org)

**Note:** The information from reference/resource material is provided as a convenience to readers. The Mushroom Council is not responsible for the accuracy, quality, safety, or nature of the content.



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[www.mushroomcouncil.com](http://www.mushroomcouncil.com)