



# GLUTAMATE

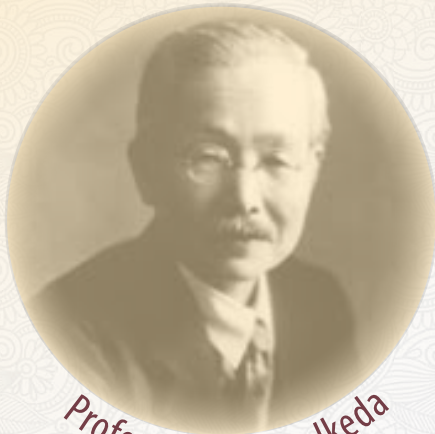
THE PUREST TASTE OF UMAMI

Brought to you by the **International  
glutamate**  
*information service*



# GLUTAMATE AND UMAMI TASTE

Umami is a basic taste, our fifth with sweet, sour, salty, and bitter. It is the taste that signals savoriness - protein from meat, fish, dairy products and vegetables.



Professor Kikunae Ikeda

While ingredient preparation and seasoning to enhance umami has been part of our food culture for millennia, the discovery that glutamate is the key to this basic taste is much more recent.

At the beginning of the twentieth century Professor Kikunae Ikeda, working at the Tokyo Imperial University, observed that there was a taste common to many savory foods which did not fall into the defined taste categories. He called this taste **umami**. In 1908, he identified the amino acid **glutamic acid**, which he isolated from Kombu seaweed, as the source of this unique taste.

The discovery of the link between **glutamate** and **umami** sparked a search for further sources of the delicious taste. **Inosinate** (isolated from dried bonito tuna) and **guanylate** (from dried shiitake mushrooms) were identified as umami substances also. When glutamate is present with inosinate or guanylate the umami taste is increased dramatically.

Recently, researchers discovered that glutamate receptors are present in the stomach. It is also known that the **gastric vagal nerve responds to glutamate** but not other amino acids. Together these findings suggest that the glutamate receptors recognize protein-rich food entering the stomach and, as a result, the vagus nerve sends food-related signals to the brain. A signal is then sent from the brain to the stomach to prepare the gastrointestinal tract for protein digestion.

**Free glutamate occurs at high levels in many savory foods.**

## FREE GLUTAMATE (MG/100G) IN SAVORY FOODS



**Kombu Seaweed** 2240



**Parmigiano Reggiano** 1680

**Nori Seaweed** 1378

**Cured Ham** 337

**Emmental Cheese** 308

**Tomato** 246

**Clam** 208

**Tuna** 188

**Broccoli** 176



**Cheddar Cheese** 182

**Mushroom** 180

**Scallop** 159

**Oyster** 137

**Green Peas** 106

**Onion** 51

**Spinach** 48

**Chicken** 22

**Beef** 10





# THE TRADITION OF UMAMI SEASONING

As it is one of our basic tastes, it is not surprising that increasing umami in food is part of cooking culture all around the world. From ancient times to the present day, cooks have used ingredients to increase umami and savory tastiness.

Garum, a fermented fish sauce, was an essential and valuable condiment in ancient Rome. Fish sauces are staple ingredients in southeast Asian cuisine. The English Worcester sauce is related, a ferment of anchovies, sugar, spices and vinegar. The soy sauce associated with Chinese food, the dashi which forms the basis of traditional Japanese cuisine, beef and yeast extracts, and tomato ketchup are **all means of enhancing umami taste**. This is because they all have **high levels of glutamate**.

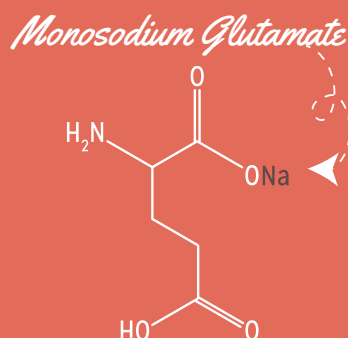
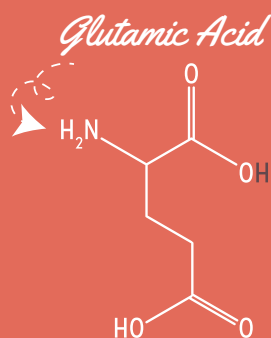
Having identified the source of umami taste as **glutamic acid**, Professor Ikeda set out to make a seasoning which could be used to increase the level of umami in a wide range of foods. He found that the sodium salt of the amino acid was ideal as it is soluble in water but resistant to humidity, and has no flavor. The development of the seasoning, **monosodium glutamate**, was a significant breakthrough and earned Ikeda recognition as one of Japan's ten 'greatest inventors'.

Today, glutamate seasoning is made from natural carbohydrate sources such as starch or molasses derived from sugar beet or sugar cane. The carbohydrates are then fermented (a process that is also used to make beer, wine, vinegar, yogurt, and many other foods and beverages), before being purified and crystallized.

Monosodium glutamate, **MSG**, is now used in cooking and food production all over the world. It is the purest way to increase umami in food as it brings no other tastes or flavors to the final dish.

## Approved Worldwide

Since its discovery in 1908, monosodium glutamate has been used safely and effectively in food. A great deal of scientific research has been undertaken into its role and safety. This research, which has been reviewed by scientists and regulators around the world including the US Food and Drug Administration, confirms that monosodium glutamate (MSG) is **safe for everyone**.



**Glutamic acid** is one of the 20 amino acids, which are building blocks for protein in the body. Because it is made by the body as part of normal metabolism it is a *non-essential* amino acid.

# UMAMI A BASIC TASTE

Our sense of taste has evolved to detect key components in food which are important for healthy development and those we need to avoid. There are five, distinct basic tastes.

Basic tastes are **universal** and cannot be created by a combination of other tastes.

Glutamate is found in abundance in our diet. It is found in two forms in food:

**BOUND** glutamate refers to the amino acid when it is part of protein.

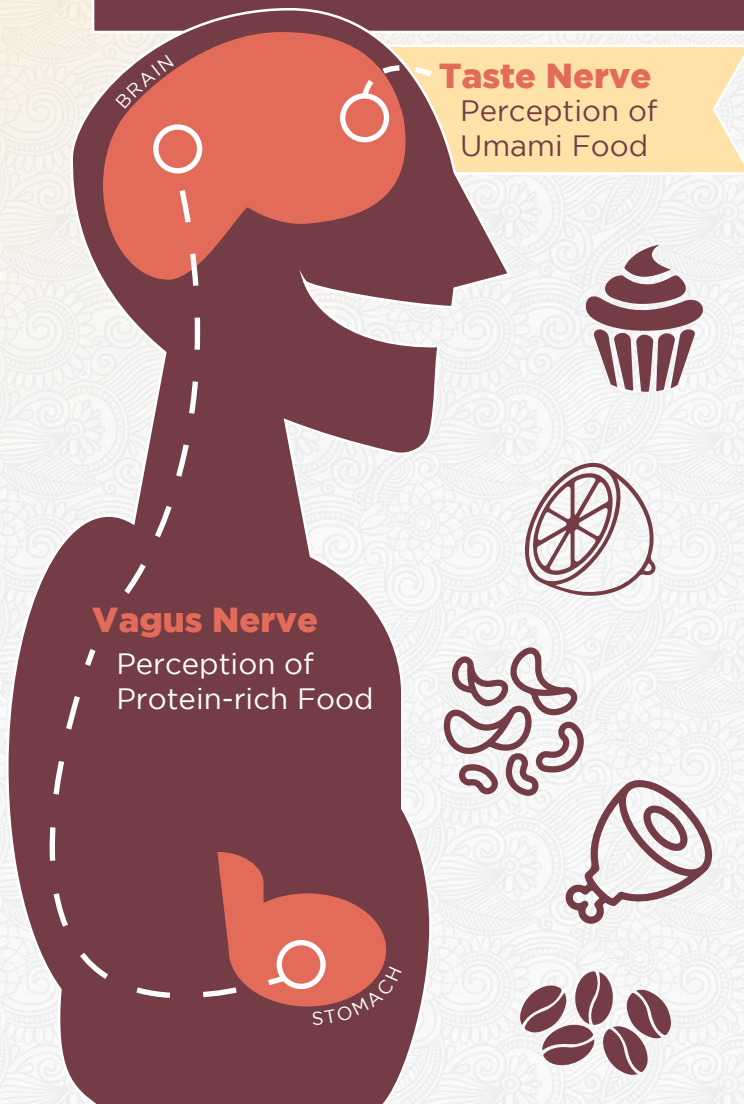
**FREE** glutamate refers to the glutamate which occurs freely in food, not as part of proteins.

Only **free** glutamate can be detected by the umami taste receptors.

The body makes **no distinction** between free glutamate in food and glutamate in seasoning (MSG).

The fact that we have evolved to taste glutamate is not a surprise once we realize that it is an amino acid found abundantly in food. It signals the presence of **protein**, our dietary source of the amino acids we need for healthy growth and development and for normal metabolism throughout life.

Taste receptors on the tongue and palate recognize each of the five basic tastes. For example, when the umami receptors come in contact with glutamate, this information is relayed to the brain where the umami taste is recognized.



**Taste** and **flavor** have very different, though related, meanings. **Taste** refers to one of our five senses, and food components that stimulate this sense are referred to as tastes. **Flavor** refers to the sensation a particular food imparts when consumed, including the combination of tastes, and its aroma and mouth-feel.

The pleasure and benefit we get from food is determined by a complex combination of factors - not only the physical attributes, such as aroma, texture, and temperature, but also mood, environment and food culture.

Basic Taste	Indicates	Taste Stimulus	Detection Level %
Sweet	Energy source	Sucrose	0.5
Sour	Organic acids; not yet ripe or spoiled	Acetic acid (vinegar)	0.012
Salty	Minerals essential for fluid balance	Sodium chloride (salt)	0.2
Bitter	Harmful/toxins	Quinine	0.00005
Umami	Protein, amino acids	Glutamate, MSG	0.03



# GLUTAMATE AND THE BODY

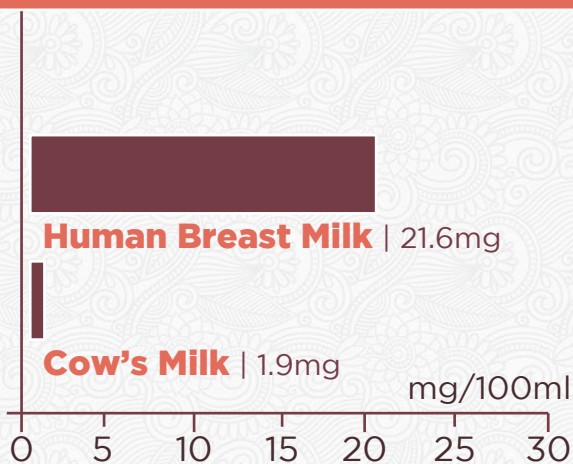
**Glutamate is an important amino acid present in virtually every protein in the body. It plays a vital role in the function of many of the important organs, including the brain, and in healthy metabolism.**

The human body synthesizes almost 50g of glutamate each day and stores almost 2 kilos (4.5 pounds) of glutamate in major organs like muscles, the brain, and the kidneys and liver.

The average person consumes between 10 and 20 grams of glutamate from their diet each day. This glutamate comes from the protein-containing foods we eat as part of our normal diet. Glutamate added as seasoning provides a very small part (less than 10%) of our daily glutamate intake. As the body makes glutamate as part of normal metabolism, it is not an essential amino acid and most of the dietary glutamate is metabolized rapidly as an energy source in the gut. In fact, research has shown that little of the glutamate we eat gets beyond the cells lining the digestive tract, where it fuels their normal function.

The way in which we hunger for the tastes we need is demonstrated by nutrition studies among infants. **Newborn babies have been shown to enjoy sweet and umami tastes and to dislike sour and bitter tastes.** Umami taste may be recognized even before birth as human amniotic fluid contains significant levels of glutamate.

Human breast milk, the sole source of nutrition for most children in their early months, is very rich in free glutamate. Indeed, a newborn, breast-fed infant consumes free glutamate at levels far higher, for its weight, than we do from our diet later in life.



The body does not distinguish between the glutamate occurring naturally in food and the glutamate added as seasoning - monosodium glutamate **brings nothing new to the diet.**



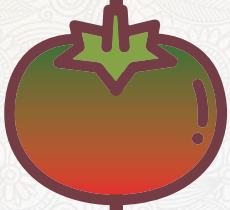
# ENHANCING UMAMI TASTE IN FOOD

Throughout the ages, and all over the world, people have sought out foods which are rich in umami. Selecting food that is ripe, and preparing or cooking it so that it tastes not only palatable but delicious is a human trait that is universal.

Increasing umami in food means increasing the level of free glutamate. This can be brought about in a number of ways.

## *Ripening*

Experience tells us that when vegetables are in season their taste and flavor are in perfect balance. As they ripen the level of many taste components, including free amino acids, increases. Free glutamate levels, in particular, reach a peak when the umami taste is optimal. As green tomatoes ripen to rich red, the level of free glutamate increases ten-fold.



## *Aging*

The taste of cheese becomes stronger and develops character as it ripens. During aging, the proteins in the cheese are broken down, eventually to free amino acids. In strong, mature cheeses, free glutamate dominates and delivers a powerful umami taste.



## *Curing*

The different processes undertaken during curing meat or fish result in the breakdown of some of the protein-releasing amino acids. So curing not only preserves the food but also enhances umami.



## *Cooking*

Cooking is a way of increasing umami in savory foods. Cooking results in the release of free glutamate and other umami substances, enhancing umami and creating a deliciously balanced final dish.



## *Adding Glutamate or Glutamate-Rich Stock*

Increasing the level of free glutamate in a dish during cooking or processing is a simple and effective way to increase umami taste and balance. In recipe development, glutamate is added at levels similar to those in traditional recipes. The taste can also be enhanced by using glutamate-rich condiments to season the dish before serving or at the table.



# WHY INCREASE THE LEVELS OF GLUTAMATE IN FOOD?

## *To Make Food Taste Balanced, Rich and Delicious*

All around the world there is a tradition of combining meat or fish - **rich in umami from the inosinate**, and vegetables - **rich in free glutamate**, in recipes for delicious dishes, stocks and stews. The dashi stocks that are fundamental to Japanese cuisine are rich in glutamate from kombu seaweed and inosinate from the dried bonito flakes called katsuobushi, making the combination very high in umami taste. In Italian cuisine, tomatoes rich in glutamate are combined with beef to make delicious Bolognese sauce. The glutamate-rich cheese topping on a beef burger delivers a new dimension to the taste, with tomato ketchup adding further umami. Now that we know that **glutamate and inosinate work synergistically on the umami taste receptors** we can understand why a combination of umami taste sources gives delicious, balanced tastes.

## *To Reduce Salt*

Adding salt (sodium chloride) to food is a traditional and popular way of enhancing flavor and richness. However, too much sodium in the diet can be bad for health so many people are trying to reduce their salt intake. Studies have now demonstrated that by increasing the level of glutamate and decreasing the salt levels, the sodium content of recipes can be lowered by up to 40% with no loss in palatability. MSG can be useful in this regard since it contains three times less sodium than salt.

## *To Reduce Fat Content*

We don't just eat to live, we get pleasure from eating. The savory foods and recipes that we enjoy are characterized by words like rich, meaty, rounded, and all have a balanced, mouth-filling flavor. Often the satisfying rounded flavor is due to the fat content of the food. With the increased understanding of umami taste characteristics and of the ingredients which deliver the unique savory taste, chefs and recipe developers are finding that umami-rich recipes can deliver rich, satisfying cuisine with lower levels of fat.

## *To Regulate Appetite*

Today there is significant interest in what makes us feel hungry or feel full, and how understanding satiety could help in understanding appetite. Studies show that we are programmed to find foods with umami taste appetizing when we are hungry but not nearly so pleasant when we are full. Future research will shed additional light on umami's role in controlling appetite.

Umami seasoning (MSG) is the simplest, purest way to add umami to food.



Japanese cuisine - Katsuobushi



Italian cuisine - Bolognese sauce



American cuisine - Burger with Ketchup

Combining ingredients rich in free glutamate with those rich in guanylate or inosinate enhances umami significantly.





# 10 THINGS TO KNOW ABOUT MONOSODIUM GLUTAMATE (MSG)

**1. Glutamate is the purest taste of umami, the fifth basic taste.**

Umami taste receptors have a special affinity for free glutamate.

**2.** We consume between 10 and 20 grams of glutamate from our diet, of which glutamate from seasoning or condiments is less than 10%.

**3. Monosodium glutamate brings nothing new to the diet;** it is the sodium salt of an amino acid found abundantly in protein.

**4.** The body treats glutamate in exactly the same way whether it comes from the food we eat or is added as seasoning.

**5.** Glutamate is important for healthy metabolism, however most of the dietary glutamate we consume is used as fuel by the cells of the digestive system.

**6.** Increasing the umami taste in food by increasing the level of free glutamate can result in reduced salt (sodium) or reduced fat recipes which **still taste satisfying.**

**7.** Replacing table salt with monosodium glutamate **reduces the sodium content of recipes,** as MSG contains one-third the amount of sodium.

**8.** Only a small amount of added glutamate is required to optimize umami taste; using more won't do you any harm but, as with salt, the food might not taste as good.

**9.** The extensive body of research which exists about this widely used ingredient has been reviewed by independent scientists and regulatory authorities throughout the world - **all have found MSG to be safe.**

**10.** Numerous well-conducted studies have failed to show a connection between MSG and any adverse health effects.

Brought to you by the International glutamate  
information service

[www.glutamate.org](http://www.glutamate.org)