Science vs. Media:
The story of glutamate (Glu) and monosodium-glutamate (MSG)

MIRO Smriga, PhD
The Glutamate Association of the USA (TGA)
Sweet
Glucose, sucrose, fructose,

Salty
Sodium chloride

Sour
Acetic acid, citric acid
Bitter

Alkaloids, calcium chloride in vegetables.

Caffeine in coffee
Umami

Glutamate
(one of 20 amino acids that make protein)

Inosinate

Guanylate
What is Umami?

A basic taste of glutamate. It is an important taste element in natural foods. It is usually described as meaty, brothy in English.

Glutamate:
One of 20 amino acids that make up proteins
Amino Acids have Complex Taste

Taste Receptors
- Sweet
- Salty
- Sour
- Bitter
- Umami

Brain

Complex taste!
Amino acid content in chicken stock

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<tr>
<th>Time</th>
<th>Leu (bitter)</th>
<th>Ala (sweet)</th>
<th>Glu (umami)</th>
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Concentration of free amino acids [mg/dL]

- Leu (bitter)
- Ala (sweet)
- Glu (umami)
Parmesan cheese is one of the world's most popular cheeses, often used as a seasoning in Italian cuisine. It has been produced in Parma already before the 10th century.

Glutamate content (g/100g): 1.4 – 1.6
Tomato’s full, rounded 'meaty' flavor comes from its heavy load of glutamates.
Stocks, Seasoning and Sauces of today: richness in glutamate

Free glutamate (g/100g):
- 0.8 – 1.3
- 9 – 12
- app. 1
Free amino acids in mother’s milk

What kind of taste does baby like?

Sweet

Umami
0.4% Glu in vegetable soup

Sour

Bitter!

Steiner et al, 1979
Production of Beer and amino acid

Raw Material

Beer

Fermentation

Filtration

Product

Amino acid

Raw Material

Fermentation

Filtration

Separation

Product
The USDA agreed that MSG, produced by fermentation, is natural (Dec. 2011)

... will permit the use of MSG derived from natural materials, containing no artificial flavoring, coloring, chemical preservative, or any other artificial or synthetic ingredient, and that is a product of fermentation and other physical treatments that FSIS has considered “minimally processed” in meat and poultry products bearing “natural” claims. . .
Glutamate is the major energy source for the gut

Studies utilizing stable isotopes have shown that:

>94% of dietary glutamate is metabolized in the intestine where it serves as THE energy source
Regulatory Status of Glutamate in the USA

The US Food and Drug Administration (FDA) recognizes food-added MSG as GRAS (generally recognized as safe) (CFR 21, part 182.1; Ref. 3).

Substances such as salt and pepper are all classified in the same section as MSG. No food-specific restrictions on their use are instituted.
New science of glutamate

Physiological importance...
Salt Intake Reduction by MSG

MSG addition 0.38%

Ref: Yamaguchi, S. (1987)
Mouth: Saliva release with MSG

- Digestive enzymes (Amylase, Protease, Lipase, DNAse, RNAse)
- Anti-Bacterial (Immunoglobulins)
- Taste (Water, Zn\(^{2+}\))
- Bolus Formation (Mucins)
- Buffer (Bicarbonate, Phosphate, Proteins)
Why is MSG perception still negative

1. **Protracted scientific resolution & weak media communication**
   Lack of effective science communication

2. **Short history of umami**
   One hundred years vs. several thousand years for salt, sugar

3. **Unfair industry competition**
   Food companies accused of hiding glutamate in Hydrolyzed Vegetable Proteins and Yeast Extracts
   No MSG labeling

4. **Perception of not being “natural”**
   ...in spite of fermentation being considered as a natural production process
Safety (1): Glutamate taste: self-limiting

In: “Umami: a Basic Taste”, ed. Kawamura & Kare, Dekker Press, 1987 (pp. 65)
Safety (2)

Brain Effects

- New born mice most sensitive
  - Blood brain barrier which protects brain not fully developed in new born mice

- MSG in food does not cause problems even in mice
  - No blood glutamate level rise when used in food
  - Greatly reduced blood glutamate rise when ingested in soup or infant formula
  - Glutamate in the body: specific pools
Safety (3)

Chinese Restaurant Syndrome

• Symptoms not reproduced in Double Blind Clinical Studies
  – Symptoms seen a range of foods (non-specific)

• MSG in food does not cause problems
  – Symptoms not seen in studies where MSG is given with food.
Allergies:

“Despite concerns raised by early reports, decades of research have failed to demonstrate a clear and consistent relationship between MSG ingestion and the development of these conditions (allergy).”

Williams & Woessner
Monosodium glutamate 'allergy': menace or myth?
Clinical & Experimental Allergy 39(5), 640-646  2009
Problems with No MSG Labeling

US FDA

While technically MSG is only one of several forms of free glutamate used in foods, consumers frequently use the term MSG to mean all free glutamate. For this reason, FDA considers foods whose labels say "No MSG" or "No Added MSG" to be misleading if the food contains ingredients that are sources of free glutamates, such as hydrolyzed protein.