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Beef Flavor Fundamentals

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Flavor Fundamentals: A Brief Overview

Most of us use the terms taste and flavor interchangeably, but they're actually different. Taste refers to the five basic receptors: sweet, salty, sour, bitter and umami (the one we didn't learn about in school). Flavor is a combination of taste plus the other sensations that influence our perception of food, such as aroma, texture, juiciness, mouthfeel and color.

The Five Taste Receptors

Receptors on our tongues and in our mouths send signals to our brains when we experience certain tastes. Salt and sour receptors are well understood while bitter and sweet receptors appear to be more complex.

Umami [oo-MOM-ee], known as the fifth taste, was discovered in the early 1900's by a Japanese scientist, Dr. Kikunae Ikeda, at Tokyo's Imperial University. He undertook research to ascertain the true nature of the "deliciousness" of konbu, or kelp, an indispensable part of Japanese cuisine. He succeeded when he extracted glutamate from the konbu, discovering that it was the main active ingredient and the key to its delicious taste. He coined the term "umami", derived from the Japanese word for delicious, umai. Nearly 100 years later, in 1997, taste researchers Stephen D. Roper and Nirupa Chaudhari of the University of Miami Medical School clearly identified taste buds on the tongue, and have since cloned receptors, that respond to umami.

Umami is described as meaty and savory or delicious. It is the taste of glutamates – the salts of an amino acid – and other small molecules called nucleotides, and is a bona fide fifth taste.

The ability to detect these five tastes has been key to our survival throughout the ages, directing us toward vital foods and away from potential poisons. Sweet means energy-giving carbohydrates. Salt indicated essential minerals for life-sustaining cell functions and wound healing. Sour says "proceed with caution," since many foods sour as they deteriorate. Umami signifies life-giving protein. And bitter warns "spit it out, don't touch it" because many natural toxins taste bitter.

The Amazing Umami Effect

The small protein compounds that trigger our umami receptors come from many sources. Meaty, savory umami flavors instantly bring to mind a great steak, but fruits and vegetables also contain these same proteins. Tomatoes, mushrooms, aged cheeses, green tea and seaweed all stimulate our umami receptors.

Part of umami's great flavor power comes from synergism, or the fact that the whole is greater than the sum of its parts. When individual umami compounds are combined, they have a magnifying effect on each other. This explains the delicious pairings of mushrooms and steaks, and red wine or tomato sauces with beef.

A 50-50 mixture of two umami compounds can produce eight times as much flavor as either one of the compounds alone.

In addition, ripening, aging and fermenting foods can dramatically increase their umami flavor compounds. That's why a truly ripe tomato, aged Parmigiana-Reggiano and fermented foods, such as red wine and soy sauce, possess enticing complex flavors – and also pair well with beef dishes.

Natural Sources of Glutamic Acid and/or Glutamates

(listed from highest to lowest content):

- Kelp
- Cheeses
- Green tea
- Seaweed
- Sardines
- Fresh tomato juice
- Peas
- Corn
- Mushrooms
- Tomatoes
- Oysters
- Potatoes
- Chinese cabbage
- Duck
- Soybeans
- Chicken
- Spinach
- Mackerel
- Carrots
- Beef
- Beets
- Milk

Natural Sources of 5'-gunylate

(a nucleotide – small part protein compound; listed from highest to lowest content)

- Dried mushrooms
- Mushrooms
- Beef
- Chicken

Natural Sources of 5'-inosinate

(a nucleotide – small part protein compound; listed from highest to lowest content)

- Bonito
- Mackerel
- Sardines
- Tuna
- Beef
- Prawns
- Chicken
- Cod

Three Natural Sources of Umami

The umami taste is produced by naturally occurring compounds – the amino acid glutamic acid, salts of glutamic acid (glutamates) and nucleotides. It's no surprise that beef contains all three of these compounds.

Beef Flavor

It's no accident that beef is often paired with certain ingredients in both recipes and menu items. And as we've now learned, when two or more umami compounds meet, it's love at first bite – an explosion of savory, meaty, delicious flavors!

Top Flavors to Pair with Beef

- Aged Cheeses*
- Bacon*
- Barbecue Sauce*
- Bell Peppers
- Garlic
- Mushrooms*
- Mustard
- Onions
- Peppercorns
- Red Wine*
- Sour Cream*
- Soy Sauce*
- Thyme
- Tomatoes*
- Worcestershire Sauce*

(*indicates umami-rich ingredients)



Classic Beef Combinations

Why does the thought of Beef Bourguignonne perk up our appetites while Sweet and Sour Beef has us wrinkling our noses? Because the flavors in classic beef dishes exist for a reason – they harmonize deliciously! Check out these classics and use them as a flavor road map, navigating you towards ideal ingredients as you develop your own beef products, recipes and menu items.

Recipe Name	Beef Cuts, Preparation & Ingredients
Steak Diane	Beef top loin (strip) steaks, sirloin or tenderloin steaks pounded, sautéed in butter, and served with a sauce of shallots, cognac or brandy, chives, mustard and cream
London Broil	Marinated and broiled beef flank steak, top round steak or shoulder steak served thinly sliced
Swiss Steak	Beef round steak pounded, dredged in flour, browned, then braised with tomato and onion
Salisbury Steak	Broiled or pan-broiled oval ground beef patty flavored with onion and served with brown gravy
Chicken- or Country-Fried Steak	Tenderized beef round steak dredged in flour or crumbs, pan-fried until crisp and served with cream gravy
Steak DeBurgo	Beef tenderloin steak served with a warm garlic butter wine sauce flavored with herbs (oregano, basil)
Châteaubriand	Broiled or grilled two-portion piece of beef tenderloin served with a béarnaise sauce and chateau potatoes
Beef Wellington	A rare beef tenderloin spread with pâté of foie gras and/or duxelles and baked in puff pastry
“Prime” Rib or Standing Rib Roast & Yorkshire Pudding	Beef rib roast seasoned with salt and pepper, roasted and served with Yorkshire Pudding (made with beef drippings, milk, eggs, flour, salt and chives)
Sauerbraten	Beef rump or round roast marinated in wine vinegar and water with carrot, celery, onion, bay, cloves, peppercorns and thyme, then browned, simmered in the marinade and finished with brown sugar, golden raisins and sometimes crushed gingersnaps.
Corned Beef & Cabbage	Corned beef brisket simmered and served with steamed cabbage, onion and carrot
Santa Maria BBQ Tri-Tip	Marinated and grilled beef tri-tip served with pinto beans, salsa and sourdough bread
Beef (Boeuf) Bourguignonne	Beef chuck or round braised in dry red wine, bacon, shallots and bouquet garni and garnished with mushrooms and small onions
Beef Carbonnade	Beef chuck or round stewed with onion, beer and bacon then sometimes topped with a mustard-flavored toasted bread slice
Beef Stroganoff	Beef tenderloin tips or tender beef strips, mushrooms, and shallots or onion sautéed in butter and served in a sour cream sauce
Cottage Pie	Cooked diced beef or browned ground beef, vegetables and gravy topped with mashed potatoes and baked in a casserole (beef version of Shepherd's Pie)
Fajitas	Beef skirt steak or flank steak marinated in lime juice, grilled over mesquite, carved and served in tortillas with pico de gallo (onion, tomato, cilantro, jalapeños)
Cornish Pasty	Diced beef, potato and onion baked in a pastry crust like a turnover
Cheese Steak Sandwich	Sautéed thinly sliced beef ribeye steak and onion served on a crusty Italian roll topped with processed cheese spread or American or provolone cheese, plus bell pepper, mushroom and ketchup
French Dip	Thinly sliced roast beef served on a French roll with pan drippings (au jus) for dipping

More Beef Classics

Recipe Name	Beef Cuts, Preparation & Ingredients
Ragù alla Bolognese Bolognese Meat Sauce for Pasta	Browned ground beef chuck simmered with tomato, onion, carrot, celery, white wine and nutmeg
Braciola Siciliana Beef Rolls, Sicilian Style	Thinly sliced beef top round or butterflied flank steak pounded, filled with a mixture of olive oil, pecorino romano cheese, capers, black olives and bread crumbs, rolled then browned and braised
Polpettine e Piselli Meatballs with Tomatoes and Peas	Ground beef chuck, onion, Parmigiano-Reggiano cheese and nutmeg shaped into meatballs, browned and simmered with tomato and peas
Beef with Bell Pepper Beef with Broccoli Beef with Asparagus Beef with Snow Peas	Stir-fried beef flank or other beef steak slices with soy sauce, dry sherry, vinegar and green and/or red bell pepper or broccoli or asparagus or snow peas
Beef in Black Bean Sauce	Stir-fried beef flank or other beef steak slices with fermented black beans, soy sauce, dry sherry, ginger, garlic, red bell pepper and broccoli or asparagus
Beef in Curry Flavored Sauce	Stir-fried beef flank or other beef steak slices with curry powder, soy sauce, garlic, onion, carrot and celery
Beef in Spicy Garlic Sauce	Stir-fried beef flank or other beef steak slices with soy sauce, vinegar, hot peppers, dry sherry, garlic, scallion, sugar, sesame oil, water chestnuts, black fungus, red bell pepper and snow peas or asparagus
Carne de res al chipotle Chipotle Seasoned Pot Roast with Mexican Vegetables	Beef chuck roast braised then shredded with roasted or boiled tomatillos, chipotle, garlic and Mexican vegetables
Bisteces a la Mexican Steak, Mexican Style	Tender beef steak flattened, pan-fried and cooked in a sauce of onion, chiles, tomato and cilantro
Milanesa de la Soledad Marinated Beef "Schnitzel"	Beef sirloin steak breaded with garlic, vinegar and bread crumbs then pan-fried

SOURCE: Compiled by National Cattlemen's Beef Association on behalf of The Beef Checkoff

Fat and Flavor

We have a love-hate relationship with it. We crave its flavor yet are told to keep our intake to a minimum. This dichotomy was illustrated in a Beef Checkoff-funded study conducted on behalf of the Cattlemen's Beef Board by the University of Nebraska. The study revealed that over 70% of consumers visually preferred low marbled steaks. However, high marbled steaks were rated more juicy, flavorful and acceptable by a taste panel than low marbled ones.

Clearly the flavor and juiciness fat imparts is one of the major reasons why we enjoy – and crave – beef. There are three types of fat in meat:

1. Subcutaneous or external fat that covers the outside of a carcass
2. Seam or intermuscular fat that runs between muscles
3. Marbling or intramuscular fat that is found within muscles

Marbling, or the visible flecks of fat within muscles, is directly related to the palatability or flavor and juiciness of cooked beef. There are ten degrees of marbling USDA graders use for evaluation, from Very Abundant to Practically Devoid.

Marbling affects flavor in two ways:

1. Fatty acids (the building blocks of fat) experience chemical changes during cooking and produce potent flavor compounds.
2. Fat acts as a storehouse for aromatic compounds that are released during cooking. Many beef flavor components are found in these aromatic compounds.

Adding Flavor... Marinades, Rubs, Pastes, Cures, Brines

Marinating

Commonly used with thin beef cuts, such as steaks, a marinade is a seasoned liquid that adds flavor and in some cases increases tenderness. Successful marinating matches the marinade type and marinating time to the beef cut.

Tender beef cuts are marinated only to add flavor and therefore need short marinate times – 15 minutes to 2 hours. Less acidic marinade ingredients are used since their tenderizing effects are not required. A highly acidic marinade can actually toughen meat fibers similar to overcooking.

Less tender beef cuts, such as several from the chuck, round, flank and skirt benefit from a marinade with tenderizing ingredients (food acids or enzymes) and a longer marinating time of 6 to 24 hours.

- Acidic marinade ingredients include citrus juices, vinegar, vinaigrettes, salsa, yogurt and wine.
- Fresh ginger, pineapple, papaya, kiwi and figs contain natural tenderizing enzymes.
- Tenderizing marinades penetrate about 1/4 inch into the surface of the beef.
- Beef marinated for longer than 24 hours may develop a mushy texture.
- Use a nonreactive glass or stainless steel container for marinating.
- Always marinate in the cooler, never at room temperature.
- Turn steaks or stir beef strips occasionally to allow even exposure to the marinade.
- Never save and reuse a marinade.
- Reserve some marinade before adding it to raw beef and use as a baste or sauce.
- Bring marinade that has been in contact with raw beef to a full rolling boil and boil for at least 1 minute before using as a sauce.

Rubs/Pastes

- Unlike marinades, rubs are dry or paste-type seasoning mixtures used for flavoring. Usually applied to the surfaces of roasts, steaks and ground beef patties just prior to cooking, they often form a delicious crust during cooking.
- Dry rubs consist of herbs, spices and other seasonings that are pressed onto the beef's surface.
- Paste-type rubs are spread over the beef and use small amounts of wet ingredients, such as oil, crushed garlic, mustard, soy sauce and Worcestershire sauce, to bind the dry seasonings.

Cures/Brines

Curing and brining methods rely on salt mixtures/solutions. For dry cures, salt and sodium nitrate are applied directly to the beef's surface. Beef is also cured by immersing it in pickling or brining solutions that may or may not contain nitrates. Originally developed as a form of meat preservation, today these methods are mainly used to produce distinctive flavors, such as in corned beef and pastrami.

Beef Flavor Questions and Answers

Top Factors Influencing Beef Flavor

- Marbling
- Quality Grade
- Cooking Method
- Degree of Doneness
- Postmortem Aging
- Marinating
- Freezing/Thawing
- Added Flavors
- Beef Production (feeding practices)

Top Factors Affecting Beef Tenderness

- Animal Maturity
- Postmortem Aging
- Muscle Type
- Marbling
- Marinating
- Mechanical Tenderization
- Proper Cooking Methods
- Degree of Doneness
- Proper Carving Technique

Warmed Over Flavor (WOF)

What is WOF?

Warmed over flavor consists of flavor and aroma defects that occur in reheated meat products. This condition is caused primarily by oxidation of some of the components of beef. Right after cooking, the conditions are perfect for the oxidation process to begin. That is why it is best to eat beef right after cooking. While the reheating process accelerates the oxidation process, WOF can be present before reheating.

What factors worsen WOF?

Cooking to a high degree of doneness (dry cookery), improper storage, microbial contamination and exposure of cooked meat to oxygen or light.

If I know I will have leftover beef, how can I minimize WOF?

- If possible, avoid using iron or aluminum cooking utensils. Certain metals accelerate the oxidation process.
- Select recipes that use ingredients with antioxidant properties (i.e., unroasted bell peppers, onions, unpeeled potatoes).
- Tightly wrap leftovers with oxygen impermeable plastic material and eliminate all air pockets.
- If an over sauce was used as part of the recipe, apply the over sauce to the entire surface of the cooked meat and wrap tightly.
- Pack and store leftovers promptly and at proper refrigerated temperatures.

Why do some fully cooked beef products I purchase not have WOF?

These products may include antioxidants and are vacuum packaged before cooking. The absence of oxygen during cooking prevents the development of WOF. Moist cooking at home also helps minimize WOF because there is no air or available oxygen in steam. This is why WOF is not commonly found in stews, soups and some pot roasts.

Liver Flavor

What causes liver flavor in beef?

Liver flavor in beef is a complex phenomenon without a clear cause. Several factors have been associated with it but additional research is needed to accurately pinpoint its cause. In general, those who detect it, do not like it. Based on current knowledge the following are some practical approaches for minimizing this condition:

- Execute proper bleeding during processing. The hemoglobin in red blood cells contains iron, which has liver flavor characteristics.
- Avoid extended aging. Fat oxidizes during aging (even wet aging) and the products of oxidation appear to accentuate the liver flavor.
- Use recipes that include the use of herbs and spices (masking effect).
- If possible, avoid cooking to a high degree of doneness.
- Some muscles that are naturally high in iron due to their high myoglobin content are more susceptible to liver flavor (i.e., beef top blade, beef round tip bottom).

Beef Faux Pas to Avoid

- **Muscle Mismatch**
 - wrong cut selected for product or recipe
- **Incorrect Cooking Method**
 - dry or moist heat cooking method not applied to proper cuts
- **Name Confusion**
 - product name of recipe title inadvertently leads consumer to a false expectation
- **Incompatible Flavors with Beef**
 - Strong competing flavors such as tarragon and rosemary that fight with beef's flavor rather than enhance it
 - Fruity, sweet flavors that are better suited to poultry
 - Overpowering pepper or herbs used to mask off-flavors or enhance visual appeal

Metallic

Where does metallic mouthfeel in beef come from?

Metallic mouthfeel is attributed to high myoglobin and hemoglobin contents since these proteins release iron during cooking. Increased hemoglobin may also be caused by improper blood removal during processing. This off flavor may be reduced by cooking beef to a lower degree of doneness.

Soapy

Why does beef occasionally taste soapy?

Commercial beef marinades may contain phosphates to help the muscle retain the marinade. Too much added phosphate can cause a soapy taste and rubbery texture. Sometimes dark cutters can also produce a soapy taste.