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Steakhouse Steaks Made Easy

Everything You Need To Know
To Grill Beef Steaks Like A Pro

version 1.0



By Meathead with David Joachim



A DEEP DIVE GUIDE FROM
Meathead's AmazingRibs.com



STEAKHOUSE STEAKS MADE EASY

EVERYTHING YOU NEED TO KNOW TO GRILL BEEF STEAKS
LIKE A PRO

MEATHEAD

with

CLINT CANTWELL

Edited by

DAVID JOACHIM



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PART I

ABOUT DEEP DIVE GUIDES

“This is my invariable advice to people: Learn how to cook – try new recipes, learn from your mistakes, be fearless, and above all have fun!”

— JULIA CHILD



[Deep Dive Guides](http://AmazingRibs.com) is the ebook imprimatur of Meathead's AmazingRibs.com. It is a growing series of ebooks in which

we have attempted to share our breadth and depth of experience on a culinary topic. They are designed to give you an inexpensive deep dive into a topic so you come away knowledgeable and confident. They contain numerous links to pages on the internet and videos. You will enjoy this book best if you read it while you are connected to the internet.

Some of this content is scattered among the 2,000+ pages on Meathead's AmazingRibs.com. Although websites are great references, they are not great learning environments, not nearly as good as books. We think that binding together carefully edited articles in an organized flow from start to finish in book format, is a far better way to learn than from articles scattered around on a website.

Some of this info appears in other Deep Dive guides because we think that it is important that they all contain foundational info on such things as meat science, safety, tools, etc. So we have included the most important info within these pages, and written new, previously unpublished, related info. Enjoy!

PART II

INTRODUCTION

“This is my invariable advice to people: Learn how to cook – try new recipes, learn from your mistakes, be fearless, and above all have fun!”

— JULIA CHILD

Whenever steak is on the menu, it’s a special occasion.

Like most food memories, both Meathead and David trace their love of steaks to childhood. It was his Dad's favorite meal. Meathead’s did his steaks on a cheap charcoal grill and David’s usually broiled his in the kitchen in the bottom drawer of their gas oven. He also liked to grill steaks over a fire when they went camping, which was pretty often.

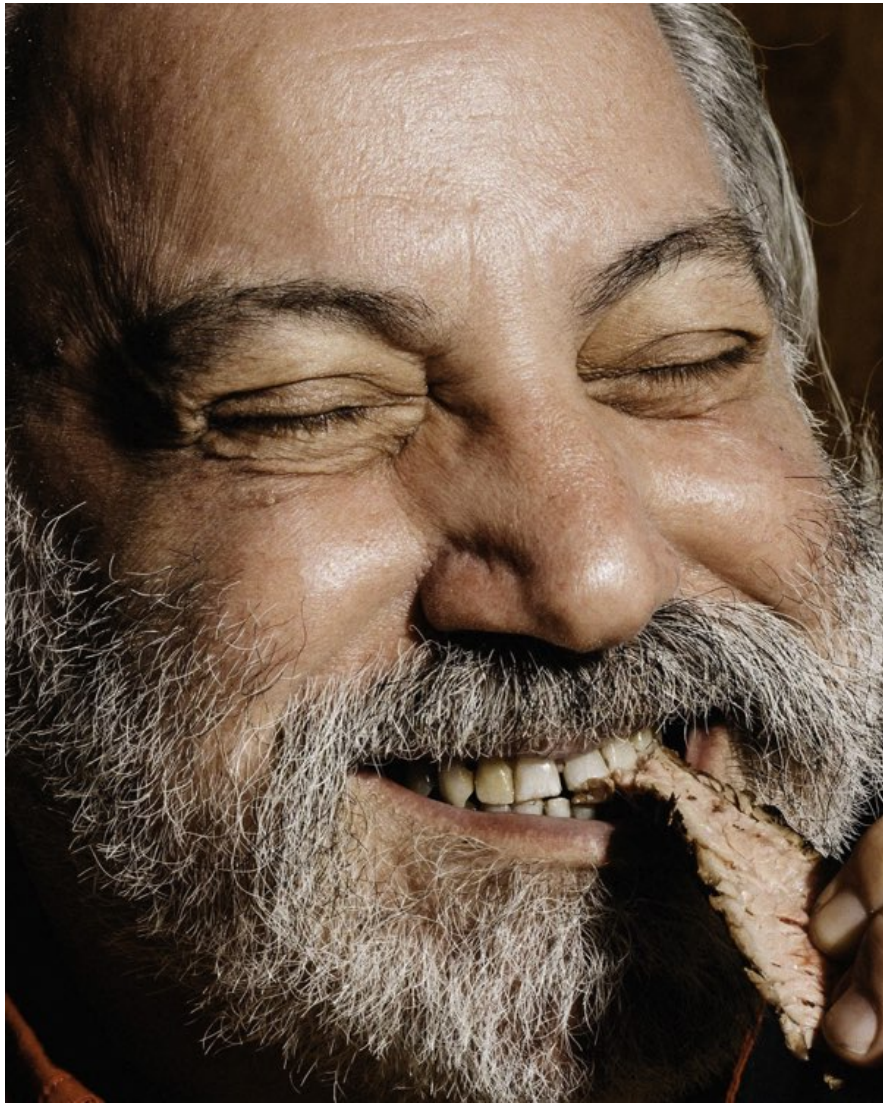
What is it about beef? It can be so incredibly satisfying. Juicy. Meaty. Full of rich flavor. With a steak, you get a maximum amount of surface area that browns and takes on deep, smoky, savory flavors. Sure, beef roasts are amazing too, but

you don't get as much browned surface, so you get less flavor. Plus, a steak tends to be a single serving, and it feels good to get your own self-contained plank of meaty goodness on the dinner plate.

The most frequent question we get is: How do the great steakhouses do it? How do they cook perfect steaks every time, with sizzling, dark, flavorful crusts, evenly done from edge to edge on the inside, tender and juicy, with big, bold, beefy flavor?

In these pages, we share everything we have learned over the years about making great steak. We cover everything from choosing the grade and cut of meat to aging steaks, trimming and tying, dry brining, seasoning, direct searing, reverse searing, and even slicing. We kept the focus on beef steaks because they are by far America's favorite. We also love pork steaks, lamb steaks, elk steaks, venison steaks, and even cheesesteaks. But you have to draw the line somewhere. Don't worry, if you love bison, the techniques and principles discussed here apply to them too. So pull up a chair, preferably near the fire, and settle in for a deep discussion of what goes into a truly exceptional steak.

ABOUT MEATHEAD



Ma

Meathead is the barbecue whisperer, hedonism evangelist, and mythbuster who founded Meathead's Amazing Ribs.com, by far the world's most popular outdoor cooking website. He is a BBQ Hall of Famer and the author of "[Meathead, The Science of Great Barbecue and Grilling](#)", a *New York Times* Best Seller that was also named "One of the 100 Best Cookbooks of All Time" by *Southern Living* magazine, one of "22 Essential Cookbooks for Every Kitchen" By SeriousEats.com, and one of the "25 Favorite Cookbooks of All Time" By [Christopher Kimball's Milk Street](#).

He was previously a syndicated wine critic for the *Washington Post* and *Chicago Tribune*. He has taught at Cornell University's School of Hotel Administration in Ithaca, NY, and Le Cordon Bleu in Chicago, and he has judged food, wine, beer, and spirits around the world. He lives in the Chicago area with his wife, a PhD microbiologist and a food safety expert, so if you dine at his house you will eat and drink well, and safely.



ABOUT DAVE JOACHIM



*D*ave Joachim (sounds like *rock 'em*) was the editor-in-chief of Meathead's AmazingRibs.com for more than four years. In addition he has authored, edited, or collaborated on more than 50 cookbooks, four of them on barbecue and grilling, including [*Williams-Sonoma Grill School*](#), [*Mastering the Grill*](#), a *New York Times* bestseller, *A Man A Can A*

Grill, and Fire It Up. His book *The Tailgater's Cookbook* and *Pure Pork Awesomeness*, co-authored with *Top Chef* fan favorite Kevin Gillespie, also have big sections on barbecue. Joachim's Food Science column appeared in *Fine Cooking* magazine from 2011 until the magazine closed in 2020. He also co-wrote *The Science of Good Food* and *The Food Substitutions Bible*, both winners of International Association of Culinary Professionals (IACP) Awards. His writing and tips have appeared in national publications such as *USA Today*, *Better Homes & Gardens*, *Cook's Illustrated*, and *Men's Health*. He has made numerous national appearances on television and radio. Since high school, Joachim has also enjoyed a second life as a drummer in various blues and rock bands in the New York City and Philadelphia areas.

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And the rest of the AmazingRibs.com team

ABOUT MEATHEAD'S AMAZINGRIBS.COM



Called “*By far the leading resource for BBQ and grilling information*” by Forbes, [Meathead's AmazingRibs.com](#) is all about the science and art of barbecue, grilling, and all forms of outdoor cooking. With more than 2,000 pages of free information, the site offers countless thoroughly tested recipes, tips on technique, original science research, myth-busting, and unbiased equipment reviews.

The site ranks among the most popular food websites in the US and is one of only a small number of sites in the Library of Congress' [Food and Foodways Web Archive](#). Other sites in the archive include the Food and Agriculture Organization of the United Nations, James Beard Foundation, Southern Foodways Alliance, Jose Andres, US Food & Drug Administration, Oxford Symposium on Food & Cookery, and Seafood Watch. We are in good company!

The site has numerous extraordinary features, among them the world's largest collection of grill and smoker reviews by

the world's only full-time grill and smoker tester, the world's largest collection of thermometer reviews and test results by an electrical engineer, a unique curing calculator, a salt conversion calculator, and it specializes in using science to bust scores of barbecue and grilling myths.

ABOUT THE AMAZINGRIBS.COM PITMASTER
CLUB



The **AmazingRibs.com Pitmaster Club** is the world's largest barbecue association with more than 17,000 paid members who enjoy a lively community forum and more than 20 cool benefits to membership including monthly drawings with prizes worth up to \$2,000. You are invited to take a free 30-day trial membership. No credit card necessary. Click here

<https://AmazingRibs.com/pitmaster>

Here are some of the 20+ benefits to membership:

- You support AmazingRibs.com and help us grow
- We block all third party ads from members
- Free \$9.95 Food Temperature Guide Magnet with 80+ benchmark temps
- Free ebooks
- Free sneak preview of **The Meathead Method**, Meathead's next book in progress
- Free **Barbecue News** magazine every month
- Free **Tailgater** magazine
- Exclusive recipes, recipes, recipes
- 3 monthly giveaways worth up to \$3,000
- Exclusive audio and video content
- Cartoons
- Great discussions and debates with knowledgeable moderators and no race, religion, or politics flamewars allowed
- 3 informative monthly email newsletters
- Meat-Ups
- Discounts on products we love
- Members can buy cool embroidered Pitmaster Club bowling shirts or inexpensive T-shirts
- Membership certificate
- Support for Operation BBQ Relief
- Support for Global Alliance for Clean Cookstoves
- Easy Autorenewal

STAY IN TOUCH

*H*ave a question? Meathead and the site's knowledgeable moderators answer reader questions promptly. Just go to Meathead's AmazingRibs.com and post your question on any page at the bottom where it says "Click for comments..."

If you find an error or a broken link in this book, [please let us know here](#).

And be sure to [subscribe to Smoke Signals](#), our free monthly email newsletter with links to new articles and reviews and more.

PART III

SAFETY FIRST



Fire, knives, pathogens, oh my! People can die from improper cooking. But the risk is very low with a little common sense and an ounce of prevention.

SPOILAGE

There are two types of spoilage: Oxidation and Microbial.

Oxidation is caused by compounds in meat, especially animal fats, combining with oxygen and changing the meat's smell, flavor, and color. Badly oxidized meat is called rancid. The good news is that oxidized meat is usually not dangerous.

Microbial spoilage is the other type of spoilage, and it is very dangerous. There are several commonly occurring *bacteria* and *viruses* in food that can spoil it. Some of these bad guys will merely have you kneeling before the porcelain god, but others can maim or kill you. The goal is to pasteurize the food, i.e. kill as many bugs as possible so that it is safe. That's different than sterilizing which kills every single microbes. We can easily *pasteurize* at home. *Sterilization* is a method that kills or removes all microbes and their spores by using one or more of the following: Heat, irradiation, chemicals, pressure, or filtration.

You can pasteurize most meats by cooking them to 131°F interior temp and holding it for two hours. At 165°F interior, bacteria are killed instantly. [For more on bacterial kill temps, click here and scroll down.](#)

BACTERIA

[The Center for Disease Control \(CDC\) estimates](#) that in one recent year roughly one in six Americans got sick from food, 128,000 were hospitalized, and 3,000 died. *The bad guys are certain types of bacteria, viruses, and parasites.* If you don't want the details, let's make it easy:



Cooking kills the bad guys. Cook food properly and you have nothing to worry about. Raw food is just plain riskier. All raw food and that includes salads.



Bacteria are everywhere. There are more microbes in your body than all other cells combined and they may weigh up to three pounds. **The biggest risks in food come from bacteria you ingest.** Most bacteria are friendly and many, called *probiotics*, are beneficial. Alas, some of them, called *pathogens*, are not so friendly, especially *Bacillus cereus*, *Campylobacter jejuni*, *Clostridium botulinum*, *Listeria monocytogenes*, *Salmonella*, *STEC* (Shiga toxin producing *E-coli*), *Shigella*, *Staphylococcus aureus*, and *Vibrio*. They are hard

to trace because they can often take a day or more to grow in your gut before they knock you down, so figuring out what it was in the fridge or if it was the restaurant lunch is hard to do.

VIRUSES

Viruses are not a major threat in food with one notable exception: *Hepatitis A virus (HAV)* a.k.a. *norovirus* usually comes from human fecal matter, often as a result of poor hand washing.

Coronavirus/COVID-19 is primarily a respiratory virus. It mostly infects the nose, throat, and lungs. Almost all infections come by inhaling droplets of moisture from the breath of other people who have been infected. The risk is greater the more viruses you inhale. The risk can be lowered by limiting your proximity to other people and by using a mask. Normal painter's masks can prevent you from spraying and can reduce the amount of spray you inhale, but they can't stop all the viruses. Masks labeled N95 are much more effective. That's what doctors prefer.

You can get sick by touching something that has the virus on it such as a grocery cart or an apple, and then transferring it to your respiratory system by touching your eye or the inside of your nose or mouth, or by eating food handled by someone who has the virus. The data says the risk of getting sick is low from touching things, especially if you wash your hands often, and keep them out of your eyes, nose, and mouth.

Food is not a likely carrier even if you eat with your hands. If the preparer is sick and washed his or her hands and didn't sneeze or cough on the food, there is likely to be no viruses or at worst a very small load (quantity of bugs). Keep in mind that food goes down one pipe and air down another so if the food is contaminated, it is possible it could get into your lungs because you breathe when you eat, but the risk is considered to be very very low.

PARASITES

Raw food can harbor parasites, most commonly adult tapeworm, tapeworm eggs, tapeworm larvae, and toxoplasma. Tapeworms are most commonly found in seafood. Cooking to 145°F will kill adult tapeworms as well as larvae and eggs. That is hotter than most chefs like to cook fish, even with conventional cooking. Fortunately, most parasites can be killed by freezing for 7 days at -4°F or for 15 hours at -35°F. Commercially frozen fish are often taken to these low temperatures. Alas, most home freezers are set to 0°F. So if you wish to cook fish to 131°F or below, you should consider buying commercially frozen fish.

Toxoplasma is found in shellfish and some mammals as well as contaminated water and cat litter. Fortunately toxoplasma is killed by freezing or cooking.

HOW DO FOODS GET CONTAMINATED?

That's quite a rogues gallery of potential contaminants. If you ingest enough bacteria, they can leave you sitting on the

toilet for hours, plant you on your knees in front of the porcelain god, send you to bed in a sweat and writhing in pain for months, propel you to the emergency room, or even the cemetery. Children and elderly are especially at risk.

It is helpful to think of all raw food as kryptonite. Of course most is perfectly safe, but you never know, and trusting your butcher is no guarantee because most contamination happens long before it hits his loading dock. And although fruits and veggies are not as frequently contaminated, if you pay attention to the news, you will know that recalls of lettuce, spinach, chili peppers, melons, sprouts, and strawberries are frequent because we eat them raw. Contaminated meats are decontaminated when we cook them properly.

The most common source of contamination is animal waste, and that includes human animals. If the bad breeds of E-coli get into water that is used for irrigation, if organic fertilizer is not sterilized properly, if Bambi or Thumper have lunch in a field of lettuce, if a steer's intestines are accidentally sliced open in the slaughterhouse, or if your butcher didn't wash his hands after using the toilet, we have a problem.

If a bluebird bombs a strawberry, if the henhouse isn't cleaned properly by a minimum wage teenager, if the water bath used to remove the feathers from chickens isn't disinfected, we have a problem.

Egg shells may look impervious, but if the hen has salmonella, it can get into the ovum before the shell hardens.

Raw fish sushi is silky and elegant, unless tapeworm eggs from seals, walruses, or whales get into your salmon. They can grow up to 60 feet inside a human.

Raw sprouts might seem like health food, but if Tweety decides to visit the alfalfa seeds or if rodents and insects nibble through the burlap shipping bags in the hold of a ship or warehouse, when we soak and warm the seeds to sprout them, we also water and warm the pathogens. **That makes sprouts the most dangerous food in the super market.**

Improper food handling also makes contamination from your hands, cutting boards, and knives a major problem.

MAKING FOOD SAFE

The most effective way to make food safe is to cook it properly. Raw food, of any kind, is always a risk. In the language of food safety scientists, you need a “kill step” in the process. Lemon juice, vinegar, alcohol, salt, and freezing will not pasteurize food. They may kill a few bad guys and hamper their growth, but they absolutely positively cannot be trusted to make food safe. Sorry, but they just don’t get the job done. Acid and salt might inhibit growth, but they won’t make your food or countertop safe. Remember, when research labs want to store their microbes, they freeze them.

To cook foods properly you must use a digital thermometer. Cooking without it is like driving at night without headlights. AmazingRibs.com has an electrical engineer who tests, reviews, and rates thermometers. His database of more than 200 is a valuable shopping guide. We do not sell any.

The excellent thermometer shown here, the Thermoworks Thermopop reads accurately in 5 seconds and sells for less than \$30. [Click here to order it.](#)



A hot dishwasher and its detergent will make dishes and utensils safe. For countertops, cutting boards, knives, meat grinders, and other things that can't go in the dishwasher, chlorine bleach is your go-to sanitizer. That's why they put it in swimming pools.

You don't want to wash down your carrots with a poison. But chlorine is an excellent disinfectant for cutting boards, countertops, knobs, and handles. Buy an empty spray bottle at the drug store and fill it with a dilute solution of household bleach.



USDA recommends a solution of one tablespoon of 5% unscented, liquid chlorine bleach per gallon of water. After washing with warm soapy water, sanitize with bleach. Wet the surface with the bleach solution and allow it to stand for several minutes. Rinse with clear water and air or pat dry with clean paper towels. Store the solution in the bottle, tightly sealed, and use it often.



STORING RAW MEATS

Can you imagine life without refrigeration? We would eat only what we killed today, or we would all be vegetarians, or we would all be experts on pickling and canning.

But you cannot keep meat in the fridge or freezer forever. Even at standard refrigerator temp, 40°F, 3 to 5 days is the longest you should keep raw meat. Keep in mind, many meats you buy may have already been stored in grocery for several days. So it is best to cook meats soon after you get them home or freeze them. Meat kept in the fridge can still host and grow dangerous microbes, so just because it is chilled doesn't mean it is safe. Cooked meats, if wrapped well, can be kept for up to a week in the fridge before they get risky.

Frozen meats stay good longer. At standard freezer temperature, 0°F, most dangerous microbes cannot grow, so frozen meat can be safe for many months. But remember, freezing does not kill microbes. Oxygen in the packaging can change the flavor and texture of the meat, and the cold can

freeze dry it. When wrapping meat for the freezer, get out as much air as possible wrapping it first with form fitting plastic wrap. If you can, use a vacuum system to suck out the air.

Ground meats have more oxygen mixed in so they start tasting funny sooner than steaks. Pork gets funky faster than lamb which gets funky faster than chicken or turkey, and beef is the last to go.

In general, the bigger the hunk of meat, the longer it will keep. Here's a rough guide that can vary depending on how well you have wrapped the meat:

- **Ground pork and sausage:** 2 months
- **Ground beef or lamb:** 4 months
- **Pork chops:** 4 months
- **Pork roasts:** 5 months
- **Lamb chops:** 5 months
- **Steaks:** 6 months
- **Beef roasts:** 8 months

Why is meat in my fridge turning brown?

At first, oxygen reacts with pigments to turn meat red. After a while, the meat starts to oxidize, which turns it brown, the same way an apple or potato turn brown.

Why does my meat shine like a rainbow?

It is simply a fluke of lighting that strikes the surface just the right way when the surface has been cut on a certain angle. Strictly refraction, not bacteria or an oil slick.

Why is my meat green?

Bad bacteria. Throw it out.

Why are there are dry white spots on my meat from the freezer?

That's freezer burn. It's like frostbite. The meat has probably been in the freezer too long and/or it was not wrapped tight. It is still safe, but the burned parts will probably be dry and bland. Trim it off and cook it, but don't serve it to Mom or the boss.

My meat smells funny, what should I do?

Sometimes meat will smell a bit odd when you take it out of a vacuum sealed plastic bag, but the smell should dissipate within a few minutes. If it still smells funny, then chances are it is funny. Throw it out. Remember: when in doubt, throw it out!

What are those boogers coming out of my burgers and my salmon?





According to the AmazingRibs.com meat scientist, [Dr. Antonio Mata](#), hamburger exudates (I call them boogers) are proteins dissolved in water, mostly myoglobin. When burgers are ground, plump muscle fibers are sheared open. As the meat begins to heat, protein and collagen shrink and squeeze out the proteinaceous fluids, which are pink at first, and then they gel and turn tan just like the meat.

In salmon, boogers consist of another group of proteins dissolved in water called *albumin*. The albumin is pushed to the surface by shrinkage caused by heat. Brining helps minimize it, but not always. Salmon boogers can usually be wiped off with a paper towel or a brush. Another good technique is to paint the surface with a simple wash of sweet wine, mirin, or a glaze.

WASHING FOOD AND CUTTING BOARDS

*R*insing meat can remove slimy fluids on the surface, but these are really nothing much to worry about. To be sure there are bacteria in them, but they will be killed instantly when heated. Rinsing is helpful to remove bone chips that might be on the surface from the butchering process because many cuts through bone are made with band saws.

Unfortunately, rinsing meat in the sink cannot remove bacteria which are embedded in the pores and cracks in the muscle surfaces. In fact, rinsing can make things worse by splattering microscopic contaminated droplets onto the sink and counters.

Jennifer Quinlan a food safety scientist at Drexel University in Philadelphia did some famous research in which she showed that rinsing meat aerosolizes tiny droplets of juices laden with bacteria all over the sink, faucet, surrounding counters, dish drains, and yourself.

Although she doesn't discuss it, the problem also arises in washing your cutting board.

She recommends you do not wash meats. But we know you want to. The solution is to turn down the water pressure and be careful not to splash. Or submerge the meat or cutting board in water.

HAZARDOUS FOODS

FOOD ALLERGIES

The Food Allergen Labeling and Consumer Protection Act requires that food packaging must declare prominently if it contains any of the eight most common food allergens: Milk, eggs, peanuts, tree nuts, fish, shellfish, soy, and wheat.

A good host will always ask guests in advance if they have any food allergies and either plan a menu that omits them, or plan a special dish for the guest with the allergy. Of course it is also the guest's obligation to inform the host so when dinner is served the host doesn't feel bad that the guest pushes away the plate.

The whole thing gets a bit complicated when people who don't have an allergy or celiac disease, but they have decided to avoid gluten or another food that they think is bad for them.

Common sense, courtesy, tolerance, and communications need to be the watchwords.



OTHER HAZARDOUS FOODS

So a food safety expert from the FDA was giving a seminar on food safety at a culinary school. Near the end of the talk she touched on the fact that some foods have effects that are cumulative and the hazard might not be evident for decades. She asked the audience if they could think of an example. After a few moments of silence an old codger in the front row raised his hand and mumbled “wedding cake.”

KNIFE SAFETY

*B*e alert and focused when using knives and sharp objects. Beverage alcohol and knives is a dangerous combo.

- Use sharp knives.
- Do not gesture and waive with knives in your hands.
- Always use a cutting board. Never cut anything in your hand.
- A damp towel or paper towel under a cutting board can help keep it from shifting.
- Make sure you have plenty of elbow room when cutting.
- If you drop a knife, get your feet out of the way and don't try to catch it! Wait for the knife to stop moving before trying to pick it up.
- Never open cans with a knife. I don't care what you saw on Iron Chef.
- Never use a knife as a screwdriver.

GRILL, SMOKER, OVEN, AND STOVETOP SAFETY

Grills, smokers, sideburners, and indoor ovens and stovetops can do massive damage to property and life if not treated with respect

- Never cook with grills or smokers indoors or in garages. They produce invisible carbon monoxide and smoke that can kill you.
- Don't keep your grill next to a furnace air inlet or even a window. The house is often under a negative pressure, and can suck in these killing gases.
- Don't keep your grill close to your house or deck railings. Beware of overhanging roof lines or trees.
- Never use gas, paint thinner, solvents, or kerosene to start your charcoal. **Chimneys or electric coil starters are the best way to start coals**, but if you use charcoal starter fluid, once the coals are smoldering never squirt them with more fluid. The flame can climb up the stream and set you on fire.
- Don't cook near gasoline or other flammables. Keep propane tanks at least two feet from the burners

unless there is shielding.

- On gas grills, always lift the lid when you ignite the burners. If you have one burner lit and want to add others, it is safe, just open the lid. A gas buildup under the hood could blow it open and flash in your face.
- On kamados and eggs, the lid seal is very tight so when you open it, air rushes in and it can flash flame in your face. Stand back and open the lid slowly.
- Store propane cylinders outdoors in an upright position.
- If you smell gas, turn off the grill immediately. On New Year's Day 2013 ESPN host Hannah Storm returned to the air with a bandaged hand, a wig, false eyelashes and eyebrows. She was injured when trying to ignite her propane grill after the wind blew the flame out. Unbeknownst to her, the gas continued to course through the jets and pooled in the lower chamber because it is heavier than air.
- Handle hot grills, coals, and hot liquids with respect. Be alert. No horseplay near cookers.
- Keep children and pets away from grills and smokers, uncooked meat, hot liquids, and sharp objects.
- Use potholders and/or insulated gloves.
- Do not discard ash until the coals are thoroughly dead. Let them sit overnight or dump water on them before you put them in your trash can.
- Bare feet, sandals, flip-flops, and loose clothes are dangerous around grills.

- Don't put small grills on flammable surfaces or glass tables.
- Before you use a new grill or smoker, fire it up on high and let it run for about 30 minutes to burn off any oil or grease or packing materials from the manufacturing process or from shipping. Click here to read more about [Seasoning and Calibrating a New Grill or Smoker.](#)
- Save the grill manual and remember where you put it.
- If you have long hair, tie it in a pony tail. And grilling is yet another great excuse to not wear a tie.
- If you pour water over hot coals, it will produce enough steam to melt your nose, and enough hot water will come out of the bottom to melt your toes.
- Heat the grates to high before cooking and carbonize grease and scraps from your last cook. Then scrub them off (read [more about grate cleaning](#)). If you use a wire brush, beware that bristles can come out and people have died from wire bristles that lodge in their digestive system. Before the food goes on, use a damp cloth and tongs to wipe off the grates and visually inspect them.
- Make sure handles of pots and pans are not sticking out over the edge of a table or counter where people walking by can bump them.
- Do not fill pots to the brim. Liquids expand when they are heated.
- If you put a wet liquid into hot oil it will spit hot oil at high velocity right at your eyes with deadly accuracy.
- Keep pets away from the front of the stove.

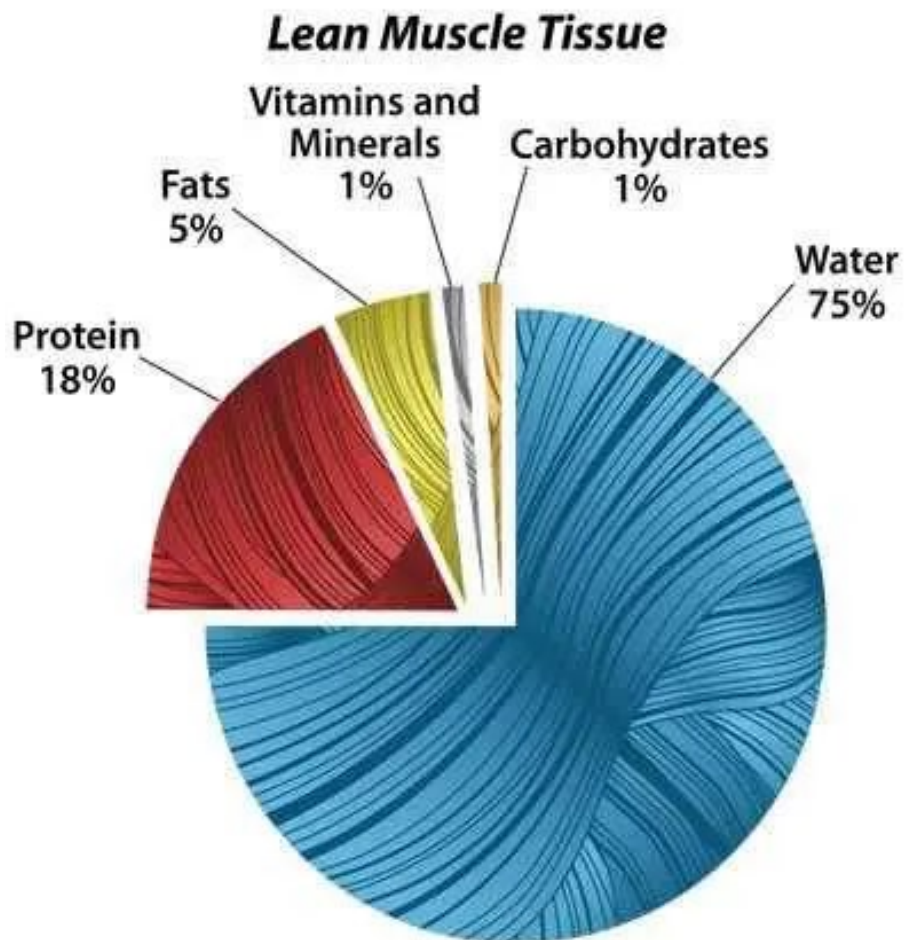
PART IV

SCIENCE

Whenever you set foot in the kitchen or sidle up to the grill or smoker, you commence a chemistry and physics experiment. Food is a complex chemical compound and when you apply energy in the form of heat you are using physics to alter its chemistry. As scientific as these processes are, they are also magical!

We could just feed you a bunch of recipes and techniques, but if you understand the chemistry and physics, well, you really don't need any recipes!

MEAT SCIENCE



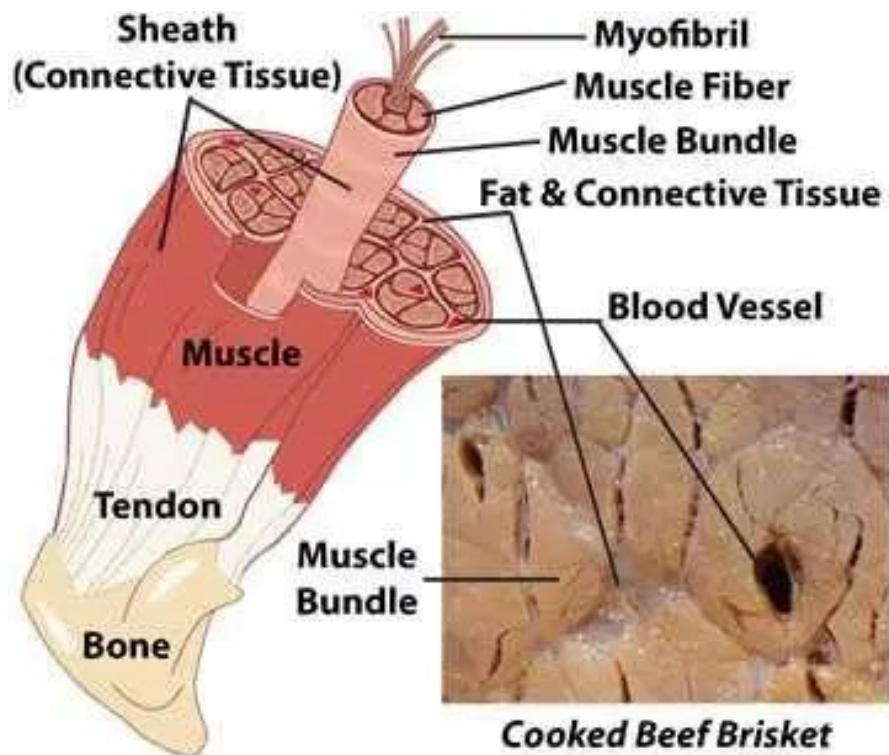
*M*eat is cut from the muscles of mammals and birds. For some reason, fish muscle is not

considered meat by some people, but it should be. It is fish muscle tissue.

On average, lean muscle tissue of mammals typically breaks down like this: Water (about 75%), protein (18%), fats (5%), carbohydrates, salt, vitamins, sugars, and minerals (2%).

MUSCLE CELLS

Muscle cells are more frequently called *muscle fibers* because they are shaped like tubes. Muscle fibers bundled together are called *sheaths*, and sheaths bundled together are called *muscle* or *meat*.



The fibers, about the thickness of a human hair, contain several types of protein, among them *myosin* and *actin* which

bind up water and act like living motors by contracting and relaxing on command by nerves. As an animal ages, grows, and exercises, its muscle fibers get thicker and tougher.



Myoglobin is another important protein in muscle fibers. *Myoglobin* receives oxygen and iron from *hemoglobin* in blood, fuel necessary for muscles to function. *Myosin* and *actin* are not water soluble, but *myoglobin* is water soluble, and *myoglobin* is the protein in meat that makes it appear red.

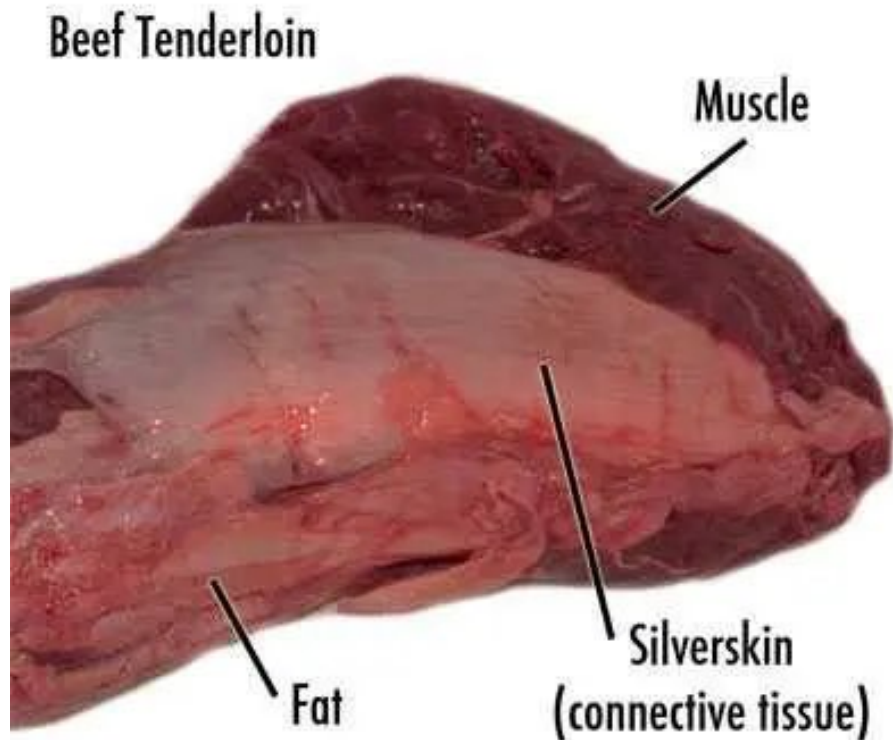
That's right, the reddish color in meat and its juices *is not caused by blood*. It is *myoglobin* dissolved in water, called *myowater*. *Myoglobin* is found only in muscle, not in the blood stream. The blood is pretty much all drained out in the slaughter house. If the stuff on your plate when you sliced a

steak was blood, it would be much darker, like human blood, and it would coagulate, like human blood. If the fluids were blood, then pork and chicken would be dark red. It's mostly just water, so let's stop grossing out our kids, and just call it juice. OK? **Every time you call meat juices blood, a bell rings and a teenager becomes a vegan.**

On average, beef has 8 milligrams of myoglobin per gram of meat, **according to the meat scientists at Texas A&M University's Department of Animal Science**, making it one of the darkest red meats. Lamb has about 6 milligrams per gram, pork about 2 mg/g, and chicken breast about 0.5 mg/g. If pork is the other white meat, lamb is the other red meat. When warmed, meat juices containing myoglobin lose their red color, become lighter pink, and eventually tan or gray.

Most of the liquid in meat is water. When animals are alive, the pH of the muscle fibers is about 6.8 on a scale of 14. The lower the number, the higher the acidity. The higher the number, the more alkalinity and less acidic. At 6.8, living muscle is just about neutral. When the animal dies, the pH declines to about 5.5, making it acidic. At this pH, muscle fibers form bunches and squeeze out juice, called purge, and that is the juice you see in packages of meat that is absorbed by the diapers that butchers put under the meat.

Muscle fibers also contain other proteins, notably, enzymes. **Enzymes play an important role in aging meat.**



CONNECTIVE TISSUE

Connective tissue is most obvious in the form of tendons that connect muscles to bones and in ligaments that connect bones to other bones. It is also visible as the thin shiny sheathing that wraps around muscles called silverskin or fascia. These tougher, chewier, rubberband-like connective tissues are mostly *collagen* and *elastin* (as opposed to the muscle, which is mostly *myosin*.) We call them gristle and they shrink when heated and become hard to chew. As with muscle fibers, connective tissues thicken and toughen as an animal exercises and ages.

A softer connective tissue called *collagen* is scattered throughout the muscle, often surrounding fibers and sheaths

holding them together. And yes, this is pretty much the same stuff the Hollywood wives have injected into their faces to get rid of wrinkles.

When you cook, collagen melts and turns to a rich liquid called *gelatin*, similar to the stuff Jell-O is made from. Cooked muscle fibers, no longer bound together by collagen, are now uniformly coated with a soft, gelatinous lubricant. This smooth and sensual substance enrobes meat in a wonderfully silken texture and adds moisture.

Lean meats such as beef or pork tenderloin, as well as most chicken and turkey, don't have much collagen. When cooking tough cuts of meat with lots of connective tissue, like ribs, brisket, and shoulder, it is important to liquefy the meat's connective tissue into gelatin: that's what makes these tough meats taste tender. This takes time. That's why these cuts are often cooked low and slow.

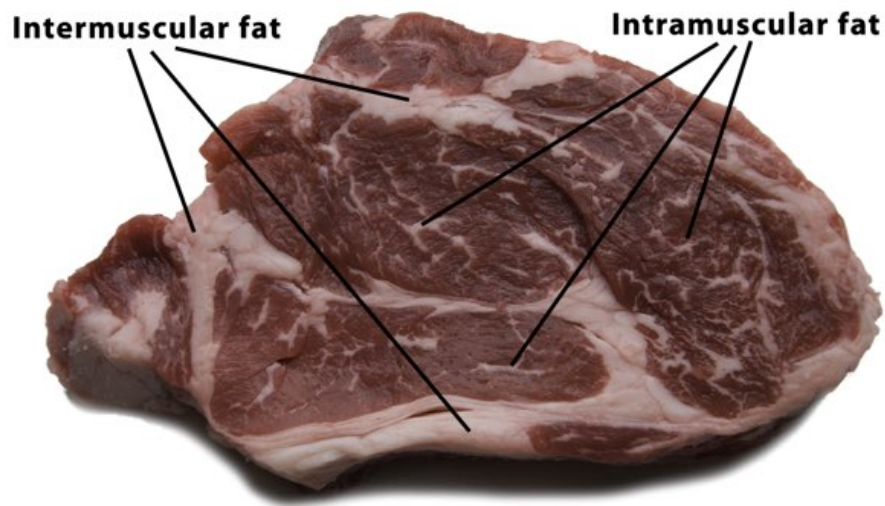
Muscle fibers start seizing up around 125°F to 140°F if heated quickly. But when heated slowly, the rubber band-like connective tissues have time to relax and do not squeeze tightly. In general, we believe it is best to cook all meats at about 225°F. Slow roasting does wonders for meat. The AmazingRibs.com science advisor **Prof. Greg Blonder** says "Think of silly putty. Pressed hard and quickly, it acts like a rigid solid. Pressed slowly, it flows." When heated slowly, the muscle fibers, instead of wringing out moisture, relax and simply let water linger inside until evaporation drives it out.

After it melts, as it chills, gelatin can solidify into that jiggly stuff which, with a little filtering, can then be called aspic and served at bridge clubs. Here's a pot of the stuff made simply by boiling a couple of chicken carcasses in water after I ate the meat, discarded the bones, and chilled the liquid. The white is fat, most of which I have removed, and the tan is jiggly gelatin.



FATS

Fats (*lipids*) and oxygen are the main fuels that power muscles. Fats are packed with calories, which are potential energy released when the chemical bonds are broken. From a culinary standpoint, fat comes in three types:



- **Subcutaneous** fats are the thick hard layers beneath the skin.
- **Intermuscular** fats are layers between muscle groups.
- **Intramuscular** fats woven amongst the muscle fibers and sheaths improve meat's moisture, texture, and flavor when cooked. These threads of intramuscular fat are called marbling because they have a striated look similar to marble.

Large fat deposits can also be found around organs, especially kidneys. On hogs, the best fat of this type, at least from a culinary standpoint, especially if you make pie crusts, is called leaf lard, and it comes from around the kidneys.

Fats are crucial to meat texture. Waxy when cold, fats start to melt around 130°F to 140°F, lubricating muscle fibers just as they are getting tougher and drier from the heat. Fat does not evaporate like water when you are cooking.

Fat also provides much of the flavor in meat. It absorbs and stores many of the aromatic compounds in the animal's food. As the animal ages, those flavor compounds build up and get more noticeable. After the animal is slaughtered, the fat can turn rancid if stored too warm, too long, or in contact with oxygen. So we have a tradeoff. The muscle fibers and connective tissues get tougher as the animal ages and exercises, while the fat accumulates and builds flavor.

Fats, especially animal fats, are the subject of great debate among scientists, doctors, dietitians, and health faddists. For many years, animal fats were thought to be dangerous and avoided. It is now thought that fats, even animal fats, contain many beneficial components, and current science argues that, in moderation, they are essential for health. A great deal of interesting research on the subject is going on as we write this. A great deal of research is contradictory.

[Read more about what we have learned about food and health in this article.](#)

SLOW TWITCH VS. FAST TWITCH MUSCLES

Muscle fibers need fat and oxygen for fuel. Fat comes from fatty acids in the animal's blood that were created by digestion of its food. Oxygen is carried by the protein *hemoglobin* in the bloodstream, and it hands the oxygen to myoglobin within the muscles.

In general, the more exercise a muscle gets, the tougher it is, and the more oxygen-laden myoglobin it needs. Myoglobin turns meat darker and makes it more flavorful. Dark meats,

like beef, lamb, duck, and goose, are made of “slow twitch” muscles that have evolved to endure slow, steady movement, and they are loaded with juicy myoglobin. Dark meats also have more fat for energy.

White meats, like chicken breasts, are mostly “fast twitch” muscles, which are better suited to brief bursts of energy, and they have less myoglobin. Chicken legs are slow twitch, and even though they are not red, they are darker than breasts. When cooked, the slow twitch muscles in dark meat have more moisture and fat and are more flavorful than white meat. White meats contains less moisture and fat, and they dry out more easily when cooked. Poultry gets more exercise standing and walking than flying, so the legs and thighs have lots of slow-twitch muscles, more pigment, more juice, more fat, and more flavor. They are also slightly more forgiving when cooked. Modern chickens and turkeys have been bred for large breasts because white meat is more popular in this country (and we can't understand why). We'll take tough and flavorful over tender and mild any day.

Ducks and geese excel at flying and swimming, and they get more exercise than chickens and turkeys, so these birds have more dark meat. Duck and goose breasts are deep purple, almost the same color as lamb or beef.

When the conventional wisdom was that dietary fat could cause heart and arterial problems, domestic pigs were bred to have less intramuscular fat. The modern pig does not get much exercise due to its transmogrification into “the other white meat.” In recent years, research has questioned the

relationship between dietary fat and health, and many experts now extol fat's benefits.

Beef is all pretty much the same color, but slow twitch muscles like flank steak have bigger, richer flavor than some of the lesser used muscles like tenderloin.

Fish live in a practically weightless environment, so their muscles are very different. Fish muscles have very little connective tissue, and that's one reason why fish never gets as tough as pork when cooked. But fish can dry out because there is not much collagen to moisturize the muscle fibers. The color and texture of fish varies depending on the life it leads. Small fish that swim with quick darting motions have mostly fast-twitch muscles and white meat, while flounder, which lives on the sea floor, has delicate flaky flesh. Torpedos like tuna and swordfish swim long distances with slow steady tail movements, so they have firmer, darker, sometimes even red flesh. For these reasons and others, fish can spoil within days of being caught, while red meats keep much longer.

BROWN IS BEAUTIFUL, BLACK IS BAD

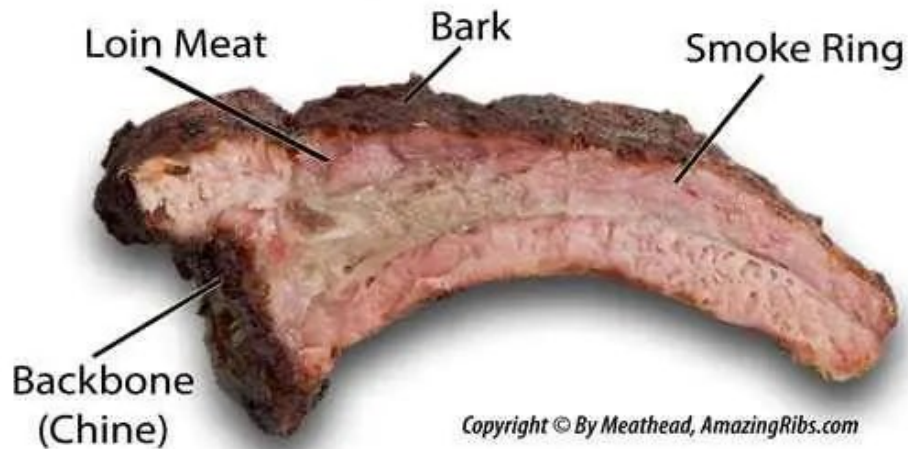


As meat cooks, the most magical transformation that occurs is the *Maillard reaction*. It is named for a French scientist who discovered the phenomenon in the early 1900s. The surface turns brown and crunchy and gets ambrosial in aroma. Who doesn't love the crispy exterior of a slice of roast beef, the browned crust on freshly baked bread? We don't think twice about it, but that brown color on the surface is the mark of hundreds of compounds created when heat starts changing the shape and chemical structure of the amino acids, carbohydrates, and sugars on the surface of the meat. If there is sugar in the rub or marinade it can undergo a flavorful transformation called *caramelization*. Click here to learn more about the [**Maillard reaction and caramelization**](#).

What you don't want is black meat. Let it go too far and it turns to carbon. [**Carbonized meat may be unhealthy**](#).

PRETTY IN PINK

Anatomy of a Baby Back



There's another color you may notice in cooked meat: Pink. Many smoked meats turn bright pink just under the surface. Some people think that pink color means that meat is raw, but not in this case. If the meat were undercooked, the pink would be in the center, not just below the surface. Pink meat near the surface is a common phenomenon called the *smoke ring* and it is caused by gases in smoke preserving the color of myoglobin. Some people think the smoke ring improves taste. That's a myth too. [Click here to read more about the smoke ring and what causes it.](#)

WHAT HAPPENS WHEN YOU COOK?

Hot air cooks the surface of meat, but it cannot penetrate, so the energy built up on the outside of the meat moves slowly towards the center, eventually cooking the meat throughout. As the internal temp of your meat rises, its color is not the only thing that changes. A number of chemical and physical reactions take place, as the molecular structure of proteins

and fats are altered by heat. Different reactions kick in at different temperatures.

Here's a general guide to temperatures organized from cold to hot. The meat temps shown here are approximate because other variables come into play such as the age of the animal, acidity, salt content, type of heat, humidity, etc. This info has been gathered from multiple sources, including meat science research papers, textbooks, and **Harold McGee's important book, On Food And Cooking**. Click here for a **complete guide to target cooking temperatures**.

25°F (-4°C). Meat freezes. Meat starts to freeze at a lower temperature than water because water in meat is combined with proteins. Water expands as it freezes and sharp-edged crystals form that can rupture cell walls, creating “purge” when the meat is thawed, which is a spilling of liquid, mostly the pink fluid protein called myoglobin. Faster freezing makes smaller crystals, resulting in less purge.

34-39°F (1-4°C). Ideal refrigerator temperature. Water is not frozen, and microbial growth is minimized. You do have **a good refrigerator thermometer don't you?**

41-135°F (5-57°C). The “USDA Danger Zone,” in which many pathogenic bacteria grow, sometimes doubling in number in as little as 20 minutes. According to the USDA, cold foods must be stored below 41°F (5°C), and hot foods above 135°F (57°C). **That's why we don't leave meats sitting around to come to room temp.**

60°F (15°C). When chilling cooked meat, liquid gelatin forms a solid gel called aspic. Gelatin happens when connective

tissues that wrap muscle fibers and connect them to bones, called collagen, melt. Yep, it's the same stuff they inject under your skin to hide wrinkles.

95-130°F (35-54°C). Animal fats start to soften and melt.

114°F (46°C). Myofibrillar proteins begin to gel, changing meat texture.

120°F (49°C). Myosin, a protein involved in muscle contraction within fibers, begins to lose its natural structure. It unwinds or unfolds, a process called denaturing. It starts to clump, gets milky, and begins firming up the muscle fibers. Purple meats, called "rare," start turning red. Fish begins to flake, and parasites begin to die.

130°F (54°C). Many pathogenic bacteria begin to die, slowly at first, but as the temp rises, they croak more rapidly. At this temp, it takes more than two hours to pasteurize meat. At 165°F (74°C), it takes just seconds.

130-135°F (54-57°C). Medium rare. Most mammal meats are at optimum tenderness, flavor, juiciness. If you eat your meat well-done, you need to snap out of it.

130-140°F (54-60°C). Fats begin to liquefy, a process called rendering. This is a slow process and can take hours if meat is held at this temp.

140°F (60°C). Connective tissues called collagens begin to contract and squeeze out pink juice from within muscle fibers into the spaces between the fibers and out to the surface. Meat begins to get dry. Myoglobin, the pink protein liquid within muscle cells, denatures rapidly and red or pink

juices begin to turn clear or tan and bead up on the surface. It is not blood!

150°F (66°C). Actin, another protein important to muscle contraction in live animals, begins to denature, making meat tougher and drier still.

150-165°F (66-74°C). This is “**the stall zone**,” in which large cuts such as pork butt and beef brisket seem to get stuck for hours when cooked at low temperatures like 225°F (107°C). In this range, moisture evaporates and cools the meat like sweat on an athlete. Inexperienced cooks panic. Eventually, temps start rising again. Whew!

155°F (68°C). Known as “well done,” meats are overcooked at this internal temperature. Much moisture has been squeezed out, and fibers have become tough. Bacteria are killed in less than 30 seconds, but spores can survive to much higher temps.

160-165°F (71-74°C). The “instant kill zone.” Normal cooking temps kill microbes on the outside of meats rapidly, so solid muscle meats are not likely dangerous since contamination is almost always on the surface. But ground meats and poultry often have bad guys beyond the surface, so you must cook these meats beyond the instant kill zone. That’s why the recommended internal temp for ground meats is 160°F (71°C) and for poultry is 165°F (74°C). When you reheat foods, you should take them up to 165°F (75°C).

160-205°F (71-96°C). Tough collagens melt and form luscious gelatin. The process can take hours, so low and slow cooking creates the most gelatin. Dehydrated muscle fibers

begin to fall apart and release from the bones. Meat becomes easy to shred. Even though the fibers have lost a lot of water, melted collagen and fat make the meat succulent.

212°F (100°C). Water boils at sea level. Boiling point declines about 2°F for every 1000' above sea level.

225°F (107°C). Ideal air temperature for “low & slow” cooking of meats high in connective tissue. It is high enough so water evaporates from the surface to help form the desired crust called “**bark**,” but low enough to get the most out of enzymes, collagen melting, and fat rendering.

310°F (154°C). The **Maillard reaction** accelerates surface browning, which is caused by chemical changes in proteins and sugars and results in thousands of delicious new molecules. The Maillard reaction begins at lower temps, but really takes off at 310°F (154°C).

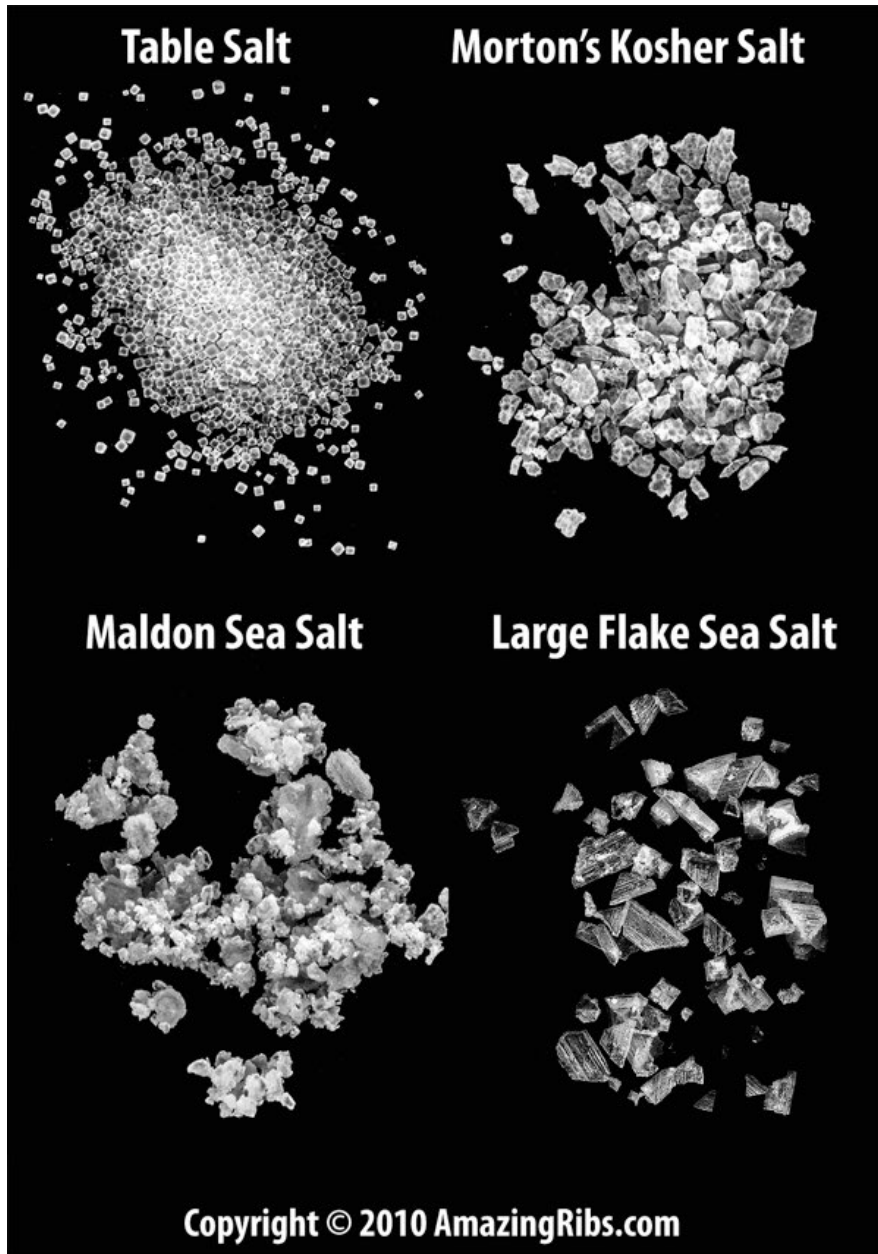
325°F (163°C). Ideal air temperature for cooking chicken and turkey so skin browns and fat renders.

361°F (183°C). Some animal fats begins to smoke.

570-750°F (299-399°C). Primary combustion temperature of hardwood, wherein it smolders and releases large quantities of unburned gases, including microscopic particles called smoke.

600-700°F (316-371°C). Flash point or fire point, the temperature at which smoke from burning fat can burst into flame. Never use water to extinguish burning fat. Smothering it works better.

SALT: THE MAGIC ROCK!



“One thing I like about Argentina, they only cook with salt. That's it.”

— ROBERT DUVALL

A stylized, handwritten signature or logo consisting of a single, fluid, cursive stroke that forms a shape resembling the letter 'A' or a similar character.

If you like your meat juicy, tender, and flavorful, (and who doesn't?) salting, also called brining, before you cook can improve it on all three fronts.

Salt does several things to the food. First of all, it amps up the taste because salt is a flavor enhancer. It does this without altering the flavor. Sugar, pepper, garlic, all the other spices and herbs change the flavor. But not salt. Salt turns the amp up to 11. And if you do it properly, it doesn't make the food taste salty.

First, it is important to know that all salt is not the same. The below quantities by volume have the same salinity because the grain sizes are different.

- **1 part Table Salt**
- **1 part Morton's Picking Salt**
- **1.3 parts Morton's Coarse Kosher Salt**
- **1.3 parts Windsor Kosher Salt**
- **2.1 parts Maldon Sea Salt**
- **2.3 parts Diamond Crystal Kosher Salt**

For more on the subject of how salt impacts food, read Meathead's article on [The Science of Salt](#). It contains an interactive salt calculator and much more info about the different kinds of salt.

Something else happens because of salt. When meat cooks, a significant amount of water evaporates from the surface and some gets squeezed out from muscle fibers that contract when exposed to heat. This water is called drip loss or purge. Lean cuts like chicken breasts can dry out easily. How do you

cook these cuts to safe temperatures without turning them into shoe leather? Surprisingly, salt can help because it helps protein glom onto water.

Salt (NaCl) is made of sodium (Na) and chloride (Cl) ions that carry electrical charges. These ions attack the proteins, causing them to unwind a bit, a process called denaturing. These altered proteins have a greater ability to retain water, so meats that have been pre-salted remain moister throughout the cooking process.

Researchers at *Cooks Illustrated* discovered that a chicken soaked in plain water and another soaked in a brine, a mix of salt and water, each gained about 6% by weight. They cooked both birds, as well as an unsoaked bird straight from the packaging. Weighed after cooking, the unsoaked chicken lost 18% of its original weight, while the chicken soaked in water lost 12% of its original weight, and the brined chicken lost 7% of its weight. Thus, brining counteracts one of the biggest problems of grilling by helping hold moisture that is near the surface, which almost always dries out by the time the center is properly cooked.

So salting before cooking, brining, has real benefits. And you need less than if you salt after cooking. And the amount of salt is small, not likely a risk to people on salt restricted diets.

There are four ways to brine: Wet brine, dry brine, brinerade, and injection. Here they all are defined.

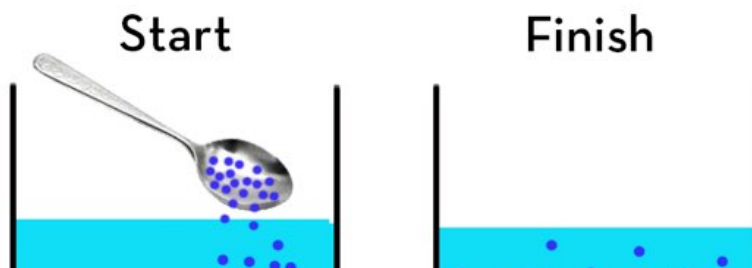
WET BRINE

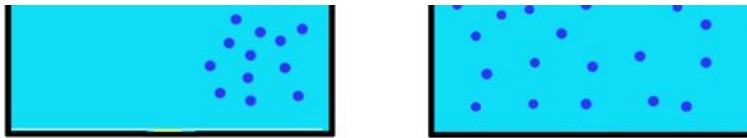
This is the traditional method of salting meat, submerging it in a solution of 5 to 10% salinity (the ocean is about 3.5% salinity). To wet-brine, you need to calculate the amount of water and the amount of salt, and after that you have a potentially large container that must be fit into the fridge.

Cookbooks tell us that salt is pulled out of the brine and into the meat by osmosis. Not true. The process is actually called diffusion. Take a look at this illustration.

Diffusion

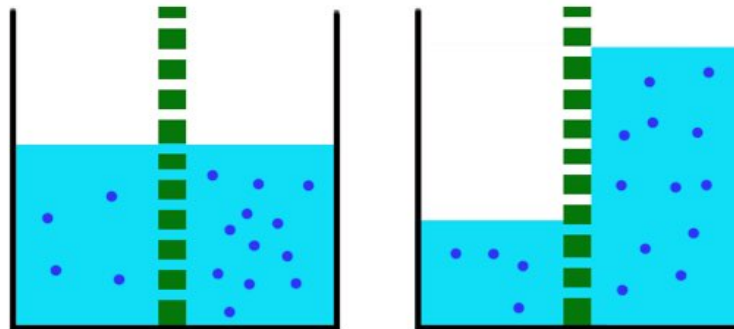
Salt moves from high concentration to low





Osmosis

Water moves from low concentration to high



When salt is added to a solution, like a piece of chicken which is about 75% water, the salt diffuses or spreads out and seeks equilibrium. Osmosis is when the water moves into salty places through semi-permeable membranes in an attempt to achieve equilibrium.

The problem with wet brining poultry is that it can make the skin soggy and harder to crisp. That's why wet brining works best on boneless, skinless breasts—food that cooks so

quickly that the absorbed moisture doesn't have time to drip out. Chicken thighs, on the other hand, are moist enough from fat that they really don't need wet brines.

If you decide to wet brine, the brine should contain 5 to 10% salt by weight. Here's a simple formula. Add one cup of hot water to a two-cup measuring cup. Then pour in salt, any salt, until the water line reaches 1 1/2 cups. That will be *about* 1/2 pound of salt by weight. Stir to dissolve then dump the solution into 1 gallon of cold water. This recipe results in a 6.4% brine regardless of the grain size of the salt.

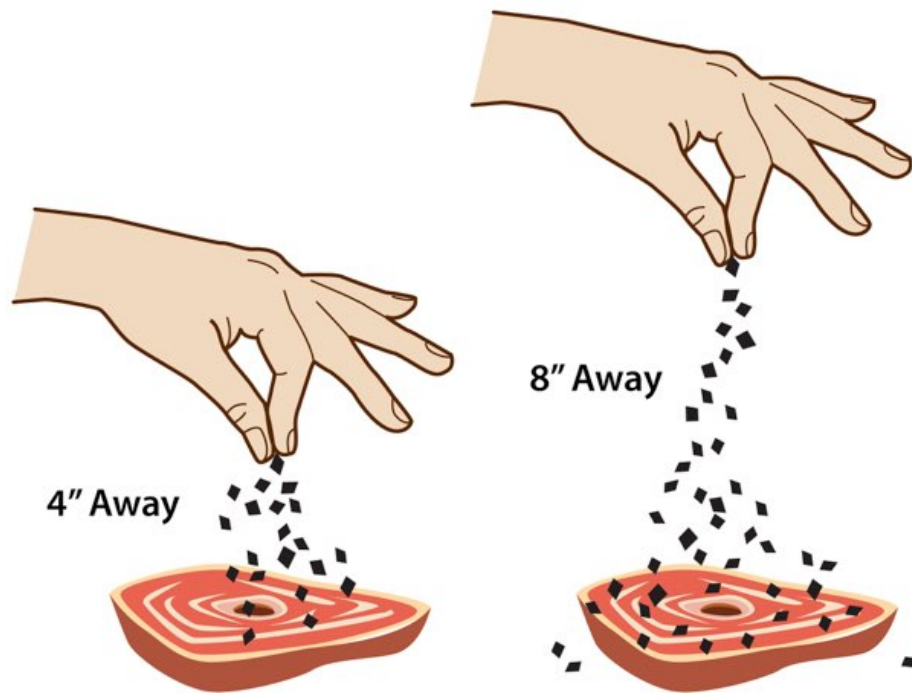
How do we know? Because a unit of salt by weight delivers the same salinity regardless of the grain size. A unit of salt by volume delivers different salinity because large grains have more air between them. In this recipe, the water infiltrates the voids between the grains of salt, compensating for the lower density.

Making brines is also easy with metric weight measurements, which are simple to scale up or down. Since 1 liter water = 1000 grams:

- **6% brine = 1 liter water with 60 grams any salt**
- **5% brine = 1 liter water with 50 grams any salt**
- **4% brine = 1 liter water with 40 grams any salt**

What's the right ratio of meat to brine? In general, soak 1 part meat in 2.5 parts brine. So for a 3 pound chicken (about 1.4 kg) use 3.5 kg of wet brine.

DRY BRINE



Dry brining is simpler and equally effective, plus it takes up less fridge space. Just skip the water. The late, great chef Judy Rodgers of [Zuni Cafe](#) in San Francisco brought the technique of dry-brining into the mainstream, and since discovering her process, which Meathead named dry brining, we almost never wet brine anymore.

To dry brine, you simply salt the meat before cooking. How much salt? Salt tolerance is so personal that it's nearly impossible to give an exact amount.

A good rule of thumb is ½ teaspoon of Morton Coarse Kosher Salt per pound of trimmed meat.

Please note that the saltiness of different types of salt varies significantly due to the size and shape of the grains. Our standard is Morton kosher salt, but if you want to use table salt instead, use half as much. [Click here to learn more about salt.](#)

If dry-brining a whole bird or a roast, concentrate more salt on the thicker parts, like the breasts. Bonus: Dry-brining helps poultry skin crisp.

How long do you need to brine? Salt is a slow poke and creeps slowly through the thicket of muscle fibers. How long should the meat be in the brine? Here are some rules of thumb, not precise. Use them for wet or dry brining, and always brine in the refrigerator.

- **½ inch thick meat: about ½ hour**
- **1 inch thick meat: about 1 hour**
- **2 inch thick meat: about 4 hours**
- **3 inch thick meat: about 12 hours**

You want to salt your foods early. If you only have 30 minutes, fine. If you have 2 hours, that's even better. Got 24 hours? That's better still. The good news is that salt

continues to migrate throughout the meat during cooking and does so slightly faster due to the heat.

Leave the meat uncovered on a rack in a pan. This is especially important for poultry because we want the skin to dry out a bit. Just be careful that vegetables and other raw foods do not come in contact with raw meat. And don't rinse it off before cooking. After a few hours most of it has gone in and is well past the surface anyhow.

Whether it's for 30 minutes or 24 hours, pre-salting gives you a better tasting, juicier meat because salt penetrates and helps meat hold onto its juices. Just sprinkle a generous amount of salt all over, about 1/2 teaspoon Morton kosher salt per pound of meat. What about marinating? Forget it. Marinating steaks is a useless technique because marinades don't penetrate the meat much and you end up throwing away most of the flavor when you throw away the marinade.

With dry brining we simply sprinkle plain old salt on the meat a few hours before cooking. No more than you would use at the table.



Sounds simple, but something complex and wonderful happens. You can see it working in the pictures here. In the first picture above the meat has been sprinkled with Morton Coarse Kosher Salt. The salt draws water out of the meat. The water dissolves the salt. See how the meat has become shiny with moisture and the fat has become splotchy?

Then, in the next picture, the meat re-absorbs the moisture (and much of the juices that have leaked out) bringing the salt in with it. Notice how the color of the fat has changed where the salt has soaked in. [Here's a slo-mo video of the process.](#)

When it is time to cook there is no need to rinse off the salt. It should all be inside the meat.

Once inside the meat, it doesn't go far. As with wet brining, it stays near the surface, but that's where the moisture is needed because that's where we apply the most heat.

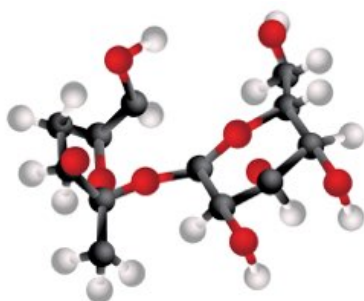
How does this work? The AmazingRibs.com Science Advisor, [Prof. Greg Blonder](#), explains: "Salt is hygroscopic, which is a fancy way to say it absorbs moisture from the environment. Water is a 'V' shaped molecule. It has two positively charged hydrogen atoms on one tip of the V and one negatively charged oxygen on the other making H₂O. This asymmetry creates an electric field, kind of like a small magnet. The polar nature of water is why it's practically a universal solvent.

"When water in the air stumbles in very close to the NaCl crystal, the salt feels the attraction of the water's weak electric field, grabs it, and then breaks apart into a positively

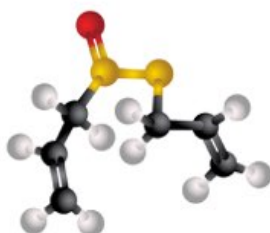
charged sodium ion and a negatively charged chloride ion. When we sprinkle salt on a steak, water molecules, some from the air, but most from the meat, are captured on the surface of the salt crystal, and eventually, accumulate into a pool of briny liquid. Then, as the salty slurry diffuses into the meat, there is less salt on the surface to attract moisture, and the juices return to whence they came. Contrary to popular myth, there is no osmosis or cells breaking."

BRINERADES AND THE TRUTH ABOUT MARINADES

This fact always shocks people: Marinades rarely penetrate meat more than 1/8 inch. The molecules are just too large. Salt is only two atoms (NaCl), but sucrose (sugar) is 43 atoms ($C_{12}H_{22}O_{11}$). Likewise, garlic, onion, pepper, and all your other spices and herbs are all too large.



Sucrose $C_{12}H_{22}O_{11}$ (Sugar)



Allicin $C_6H_{10}OS_2$ (Garlic)



Water H_2O



Salt Ions NaCl

And for sure, oil in a marinade doesn't penetrate because meat is mostly water and oil and water don't mix. Here's a piece of chicken marinated for hours with a typical oil and vinegar marinade with some spices, herbs, salt, and some green food coloring to help us prove the point. As you can

see, there is no penetration (look at the bottom) except for salt, the slightly milky color about 1/4 inch below the surface.



If you add salt to your marinade, it will find its way into the food. We call that a brinerade. How to make it? Prepare your marinade (skip the oil) and add the same amount of salt you would if you were making a wet brine.

- **6% brine = 1 liter water with 60 grams any salt**
- **5% brine = 1 liter water with 50 grams any salt**
- **4% brine = 1 liter water with 40 grams any salt**

So why marinate? Because marinades *can flavor the surface*, and if there is acid in the blend, it can tenderize the surface. And if there is salt it can brine. On the downside, a marinade can make poultry skin soggy and prevent it from crisping, and wet surfaces don't brown as well as dry ones.

Remember: Brown is beautiful. Here's a way to improve marinades. Add salt to a marinade and it becomes a brinerade. The salt penetrates and helps retain moisture,

sugars help with browning, and everything else flavors the surface.

INJECTING



“I think everybody should have a great Wonderbra. There's so many ways to enhance.”

— CHRISTINA AGUILERA

ou don't need a Wonderbra to enhance chicken and turkey breasts. Or, for that matter pork butt or beef pectorals. The truth is that rubs, mops, marinating, brining, and sauces can deliver a lot of flavor to the *surface of meat*, but if you really want to get salt or flavor deep into meat, the solution is injecting.

Having an injector also opens up other fun possibilities: stuffing jam into donuts, syrup into ice-cream, and melted butter into squash.

Many meat processors routinely inject meats like turkey, chicken, and pork at the factory. Injecting, or enhancing as food processors call it, is a sure fire way to get the flavor and juiciness down deep. And it is the only way to get fats, herbs, spices and other large molecules deep into meat. You don't have to worry about oversalting, there's no waiting — you can do it at the last minute, you have less waste, no huge containers are needed, there are no refrigerator space problems, and there are few safety issues.

The secret to injecting is to go easy. A good guideline is to shoot for 1 to 2% salt. It is like brining and the salt helps retain moisture as well as enhances flavor. I skip the big flavors like garlic, pepper, and herbs that mask the natural flavor of the meat. I have judged pulled pork and brisket at barbecue competitions where the meat was gushing juice, but it didn't taste like meat. It tasted like apple juice and garlic. I want pork that tastes like pork, beef that tastes like beef, and turkey that tastes like turkey.

The best solutions are salt water, salted butter, or [stock](#). And you don't need much. Muscle is 75% water and it is saturated. There isn't much room in there for more liquid. Your injection will go in between the muscle fibers and bundles, not within the fibers, so you won't need much. [Check out my recipes here.](#)

Many competition cooks like to inject with a product called [Fab B Light](#) or [Butcher BBQ Brisket Marinade](#), both moisturizers, tenderizers, and flavor enhancers. Fab B contains hydrolyzed soy protein, vegetable oil, sodium phosphates, monosodium glutamate, autolyzed yeast extract, xanthan gum, disodium inosinate, and guanylate. Butcher contains hydrolyzed vegetable protein (hydrolyzed soy and corn protein and salt, with partially hydrogenated vegetable oil [cottonseed, soybean] added), monosodium glutamate, sodium phosphate, and xanthan gum. Some traditionalists think this is way too Barry Bonds and are repulsed by the idea. The results speak for themselves. They are winning. A lot.

To inject, you need a gizmo, and something to put in it. [Click here for our reviews of injection gizmos.](#)

SEASONINGS AND RUBS



*M*eats are blank canvases to be painted with herbs, spices, and flavorful liquids. Rubs are simply spice blends that are sprinkled or rubbed onto meat before cooking. The rub should fuse onto the meat's surface and enhance the meat, but not overwhelm it.

It is helpful to think of salt as a treatment for the interior of a food, and herbs and spices, as a treatment for the exterior.

Every good barbecue cook should have a signature rub to brag about. In the recipe section of this book (below) there are a few rubs to get you started, then you can start riffing and invent your own. Once you find a rub recipe you like, make a batch and put it in a large spice shaker with a lid. If it clumps or cakes, take a tip from diner waitresses: Take some uncooked rice, place it in the oven at the lowest temperature to dry it out, and add it to the jar to absorb excess moisture.

Compared to salt, spices and herbs are huge molecules that just don't get more than a fraction of an inch past the surface. Think of salt as a treatment for the interior of the meat, and spices and herbs as an exterior treatment, like a sauce. The juices of the meat mix with the herbs and spices and they develop flavor during chemical reactions catalyzed by the heat of the fire. They form the flavorful crust.



Adding sugar to a rub or brinerade has some benefits. It aids in browning, especially at lower temperatures. Be aware:

Sugar burns easily, so you have to be really careful about temperature control and watch the cook very carefully. Also, if you smoke a wet brined meat that had sugar in the brine, it can get a slight hammy taste.

Beware: Some commercial rubs can be half salt. That's some expensive salt! But salt and spices should be applied differently. Because salt penetrates the meat, you need to apply it based on the weight of the meat. Because spices sit on the surface you apply them based on the surface area. For example: A slab of ribs and a hunk of pork shoulder might have the same amount of surface area but the shoulder can weigh 2 to 3 times the ribs and be many times thicker. So you need more salt on the shoulder but the same amount of spices. For this reason (and others) you should consider making your own rubs sans salt. [We have rub recipes on AmazingRibs.com for pork, poultry, beef, lamb, seafood, and more.](#) But if you don't want to bother, [we have bottled rubs with salt for sale on our site.](#) And yes, there is salt in them. Consumers expect rubs to contain salt and there just isn't room on the label to explain why it should be applied separately. Besides, if we left out the salt we would be priced out of the market.

Before sprinkling on the rub, many cooks like to coat the meat with a layer of mustard, ketchup, mayo, or water as a glue to hold onto the rub. These "slathers" have almost zero impact on flavor because they drip off and dry up during the cook. But they do work as a glue. Clint is partial to mayo because it is mostly oil and fat is flavor. Meathead just wets his hands and pats the meat to moisten it.

Don't be stingy with the rub. With a spice shaker with large holes, sprinkle on enough to coat the surface but not so much that you can't see the meat below. About 1 teaspoon for every 4 x 4-inch square is a good rule of thumb to start.

DON'T TRY TO BRING IT TO ROOM TEMPERATURE

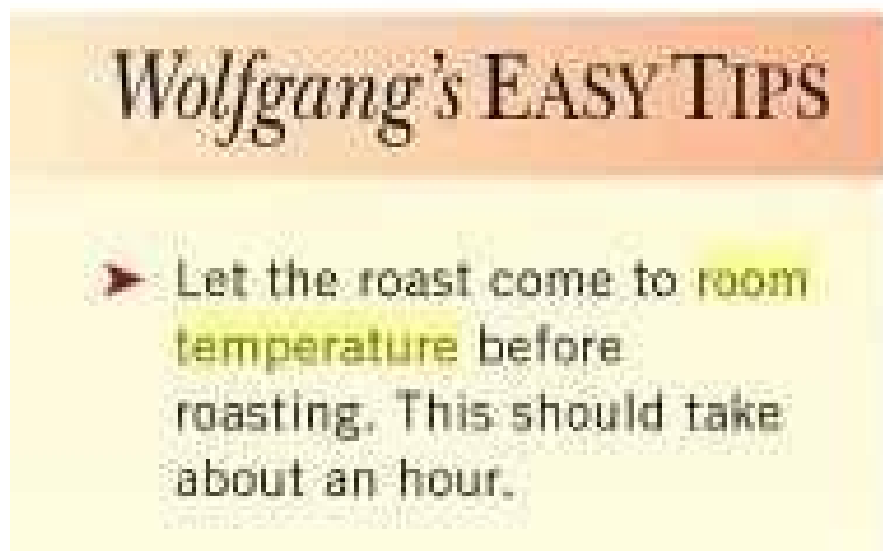
A lot of recipes, including steak recipes, say that you should take the meat out of the fridge an hour or two before cooking and "let it come up to room temp."



Here's the theory: Say you want a steak to be served medium rare, about 130°F. If your fridge is 38°F, then the meat must climb 92°F. But if it is room temp, 72°F, then it needs to

climb only 58°F. It will cook faster and there will be less overcooked meat just below the surface.

Here's a picture of a page from a cookbook by Wolfgang Puck, a brilliant and famous TV chef with many restaurants. He says a big old roast should come to room temp in about an hour.



We tried it with a 3/4 inch steak and a really accurate thermocouple. It took just over an hour for the center to come to room temp. A 1 1/2 inch steak took just over two hours for the center to come to room temp. A 4 1/2 pound pork shoulder 3 1/2 inches thick took, are you ready for this, 10 hours! After two hours, the pork shoulder was only 49°F in the center, and after four hours it was only 56°F. Just a bit longer than Chef Puck thinks. Worse, after five hours it began to smell funny.



Why so long? Remember, meat is about 75% water, and most of it is trapped in cell fibers. This makes it a great insulator. So even though the center of a pork butt is only 1 3/4 inches from the surface, it takes 10 hours for the 72°F heat to penetrate. A mere 30 minutes in the oven at 225 to 325°F will warm the meat as much as an hour at a room temp of 72°F.

Now we know that, in theory, all contamination on whole muscle meats like steaks and roasts will be on the surface and not deep into the meat. We understand that within a minute on a hot grill all of the surface microbes will be dead. But we also know that the population can double in 20 minutes at room temp. So the idea of leaving a steak at room temp for more than 30 minutes or so gives us the creeps, especially if there are cracks and pits in which microbes can hide. Especially knowing that some processors use blade tenderizers, tiny knives that cut into the muscle to soften it, but in the process push surface contamination deep into the center. This is a practice that should be banned. Especially

since we will be cooking the steak to only 130°F, a temp that can kill microbes, but it can take hours to kill them all. But more important, over extended periods of time, putrefaction and rancidity set in, the meat starts to smell bad, and the entire flavor profile can change.

And it should go without saying, never leave poultry, burgers, or ground meat at room temp for more than a few minutes. They are susceptible to contamination within the meat and sitting around can really mess up these meats.

Think of letting cold meat sit at room temp as cooking it in a 72°F oven and then moving it to a hotter oven. It will take much longer than if you just put it in the hotter oven to begin with. But the reverse sear theory comes into play. Gentle heating helps ensure that the meat's internal temperature is more even from top to bottom than if it is exposed to high heat right away. But the microbial danger zone is in play as well. At 72°F, microbes are very happy and reproduce with abandon.

A steak cooked reverse sear. In the reverse sear process you are heating gently in a 225°F oven during the initial stage and then searing at very high "Warp 10" temperatures at the end. As we have shown, it can take two hours for a steak to get to room temp and in the oven/grill/pit it gets there in about 15 minutes. It is actually faster to go directly to the grill from the fridge.

A steak seared at Warp 10 first. You are clobbering the meat with a lot of heat and if you want to serve the meat at optimal medium rare, 130°F, you want the interior to remain

relatively cool so it doesn't overcook. Letting the meat come to room temp is actually self-defeating in this scenario. In fact, you are better off cooling it down in the freezer a few minutes.

Also, we now know thanks to the AmazingRibs.com science advisor, Prof. Greg Blonder, smoke sticks better to cold surfaces. So if you want a smokier tasting steak, take it straight from the fridge to the grill.

Here are three beer cans. The one on the right sat on a desk during Blonder's experiment. The one on the left was filled with ice water and placed in a smoker. The one in the middle was empty and placed in the smoker. You can see that the cold wet surface of the one on the left attracted more smoke and thus more flavor.



So in our homes, it's out of the fridge and onto the grill or oven.

NO RESTING

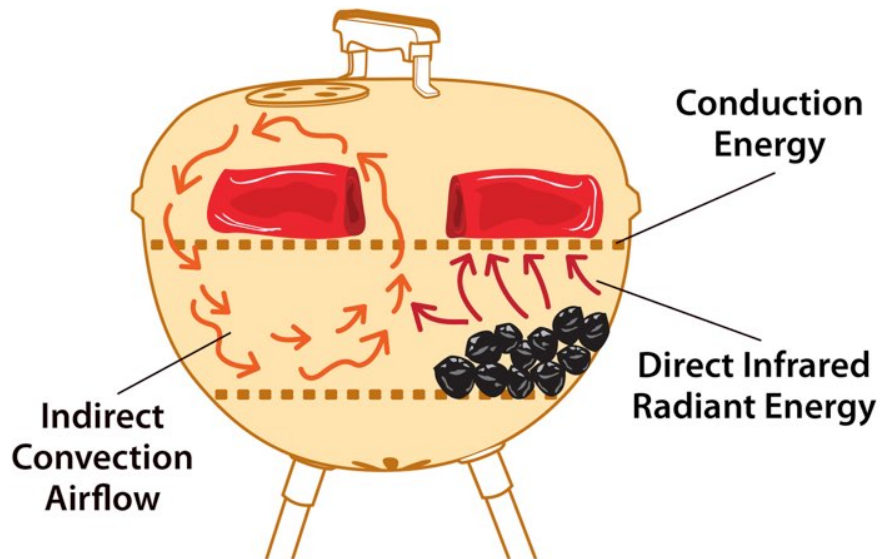
Do not tent chicken with foil when it is finished cooking because the steam trapped under the foil softens the skin. Resting does not redistribute juices (that's a myth). And while it is resting, see all that steam? It is moisture that you want in the meat! Serve it hot and moist. Don't let it sit around cooling and drying out and overcooking via carryover.

3 TYPES OF ENERGY AND 2-ZONE COOKING

THE 3 TYPES OF ENERGY

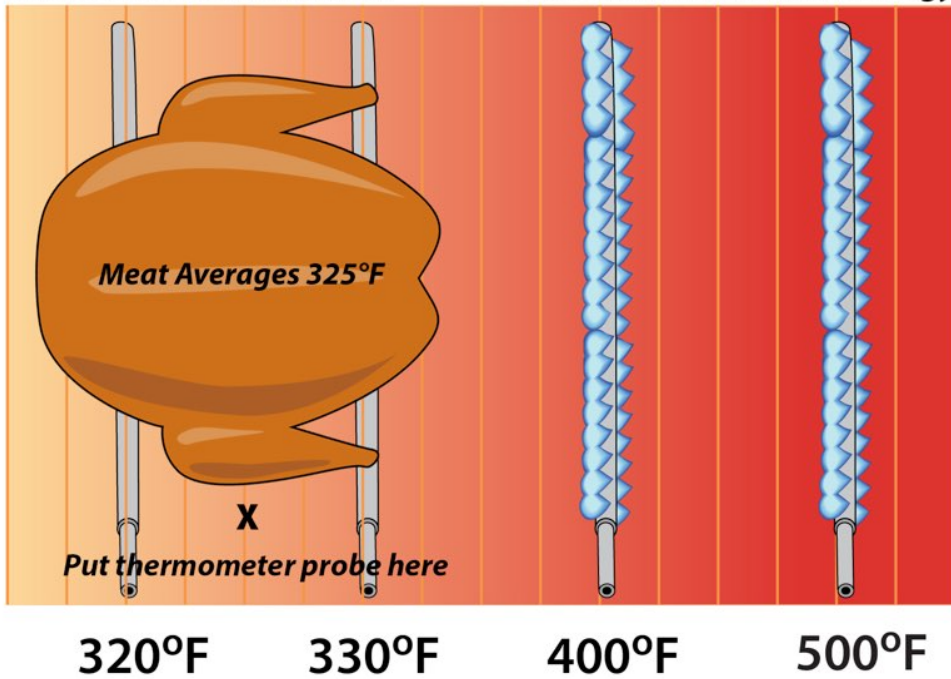
*I*nside a grill there are three types of energy: Conduction, infrared radiation, and convection airflow. It is important to think of these as energy rather than temperature. As an example, turn your indoor oven to 200°F and stick your arm in there. You can do this. It won't burn your hair off. Now touch the metal grates. When you get back from the hospital you will understand that, although the air and the grates were both 200°F, they held and delivered vastly different levels of energy. That's why thermometers are important in measuring energy in a grill but they don't tell the whole story.

Convection vs Conduction vs Radiant Energy



Indirect Convection Airflow

Direct Infrared Radiant Energy



Conduction is the most concentrated energy and a basic example is food in contact with hot metal. Conduction from hot metal is what creates grill marks on the food.

Infrared radiation (IR) usually comes from flame or glowing embers directly below the food. This concentrated form of energy packs a wallop and helps sear foods and get dark crusts in a hurry. When you stand in the sun, you are getting bombarded by IR. Yes, there is ultraviolet (UV) that causes sunburn, but there is much less UV than IR. When you place food directly above hot coals or gas flames, you are subjecting it to IR. It is like putting it in the sun.

Both IR and conduction produce enough energy to sear foods. Searing is when food turns brown as a result of two chemical reactions called the Maillard reaction and caramelization. That brown is flavor.

You can put a thermometer in a grill but it can be misleading because conduction and radiant energy are best measured in calories, not degrees of temperature. That's why we often refer to IR on as Warp 10 rather than measuring the air temp, a dumb Star Trek reference.

Convection airflow is the warm air circulating inside the grill, especially when the lid is down. Convection is not very good at searing. People often brag that their Big Green Avocado can hit 600°F or more, and although that is great for cooking food, it is not as good at browning it as conduction or radiation. Cooking with convection energy is best called roasting.

Once you understand these basics of energy transference you can use them to your advantage. And you thought you left physics behind in high school.

THE IMPORTANCE OF 2-ZONE COOKING

Cooking, indoors or out, is all about controlling energy and the way to do that is with 2-zone cooking. The concept is simple. You divide your grill in half. One side has IR from glowing coals or flame, the other side has no energy source beneath it and is warmed only by convection airflow. With this setup you can move food from gentle low energy that slowly warms the food and doesn't shrink the proteins and squeeze out juices, to rip snorting high energy that can sear the exterior.

For this reason we are not big fans of egg shaped kamados. Most of them are not easily set up in 2 zones.

PART V

TOOLS



You don't need a lot of fancy expensive tools to get started. You can accomplish wonders with a simple kettle grill or a two burner gas grill, a pair of tongs, a brush, and a digital thermometer.

That said, there are some great upgrades and enhancements that come in handy if you can afford them. Here are some of our recommendations.

At AmazingRibs.com we employ the world's only full-time grill and smoker tester and he maintains a database of detailed reviews and ratings of hundreds of cookers.

We also have an electrical engineer outfitted with special equipment to test and rate and review thermometers, the single most important tool for making safe and tasty food.

In addition, our experienced team tests and reviews everything from pizza ovens, to tongs, to spatulas, grill grates, knives, knife sharpeners, gloves, coolers, scales, pots and pans, kitchen equipment, all manner of accessories, and every year we pull together a list of the best new products and a great gift guide.

[Click here to check out our Product Reviews section.](#)

CHARCOAL GRILLS

Charcoal grills are the most versatile all-purpose outdoor cooker. When set up properly, the good ones can do both high energy infrared searing and low energy convection air roasting, as well as smoking. Their main advantages are that charcoal generates more energy than most gas burners and you can capture more smoke because the best charcoal grills allow you to control airflow. Gas grills have large permanently open vents so you can't easily contain the smoke, but they can do a respectable job. You just need to burn through a lot more wood.



Here is a picture of two slabs of ribs, one cooked on charcoal, one on gas. You can see the difference in color caused by the differences in the smoke.



To set up your grill for 2-zone cooking, simply pile lit charcoal briquets on one side of your grill's charcoal grate to create a hot (direct) infrared heat zone and a cool (indirect) convection airflow zone. You can also add a water/drip pan on the empty side of the charcoal grate and/or a second one directly above the charcoal on the main cooking grate if you wish. If you add water pan(s) you are adding moisture to the atmosphere, and if the water pan is above the heat source you are further protecting the meat from direct heat; the water absorbs heat, helping to keep the temperature down but does not steam the meat which will make it mushy. If you keep the oven temp at 225°F, the water should not boil because the surface area will allow evaporation that will cool the water keeping it below 212°F. Hard to believe, but true. If the water is boiling, you are running hot.

Intake dampers (on the bottom) are more effective at controlling the temperature than the exhaust dampers at the top of the grill because they reduce the supply of oxygen to the coals. So monkey with the intake dampers to control temperatures. Take your time getting the temperature right and try to maintain it throughout the cooking process.

Another reason for water pans is because water condenses on the relatively cool meat and keeps it cool, slowing the cook. Furthermore, smoke particles stick to the wet surface better than dry surfaces.

Cooking at 225°F will allow the meat to roast low and slow, liquefying the collagen in connective tissues and melting fats without getting the proteins knotted in a bunch. It's a magic temperature that creates silky texture, adds moisture, and

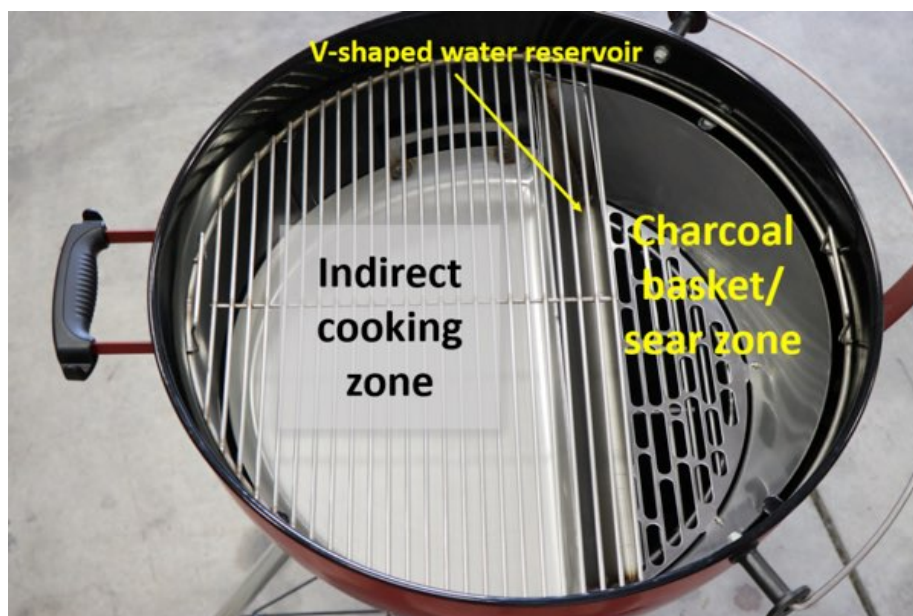
keeps the meat tender. If you can't hit 225°F, get as close as you can. Practice without food. Click here for more about how to [calibrate your grill](#).

While lump charcoal is an option, we prefer briquets because they give us more control and we are control freaks ([read our article on charcoal to see details](#)). Absolutely do not use the instant igniting stuff that has solvent in it.



Chimney starters are by far the best way to start charcoal, especially for long slow cooking where the smell of the solvent in charcoal starter fluid can ruin the taste of the meat. [Read how to start a charcoal fire here.](#)

If you are using a charcoal grill or smoker, wait until the coals are white. They emit less smoke and the smoke from charcoal is not as good tasting as the smoke from wood. Then add about four ounces of dry hardwood or fruitwood to the fuel for at least the first hour of cooking. Do not overdo it on the wood as too much can result in a bitter and overpowering smoke flavor in the end product. If the result isn't smoky enough, add more the next time you cook.





If you are shopping for a grill that can also smoke, a great inexpensive solution is the good old fashioned Kettle. A stripped down model of the venerable Weber Kettle is still less than \$200, and with the addition of a device called the Slow 'N Sear (above) for about another \$100, you get a system that can both grill and smoke superbly, albeit with limited capacity. On one side it corrals all the coals behind a water reservoir; the food goes on the indirect side to smoke-roast at the perfect temperature. When you want to sizzle on the sauce (or sear a steak) you place it right above the glowing coals.



Another option are the Slow 'N Sear Kettle Grills. Similar to the Weber, it has several modernizations not the least of which, the two-zone insert is included. It has four legs, a thermometer port, and a side shelf.



One of our favorite charcoal grills is the [Portable Kitchen 360](#) (a.k.a. PK 360) for about \$800 (above). Its rectangular shape makes it easy to set up in 2 zones and the coals are close to the cooking grate, making it superb for searing steaks.



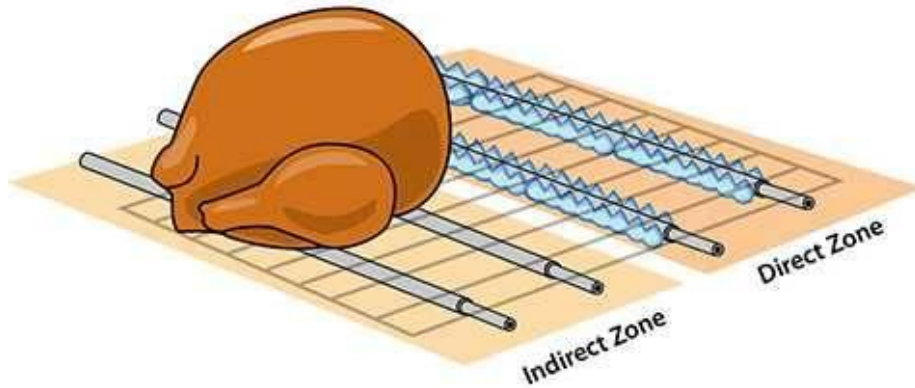
Our all-time favorite is the [Hasty Bake 35.7](#) (above) for about \$3,600. It has all the bells and whistles and best of all, you can raise and lower the charcoal grate to control heat. Hasty Bake makes less expensive models you should consider if you fainted when you saw that number.

[Click here to see our favorite charcoal grills.](#)

GAS GRILLS

If you are using a gas grill you can easily create a 2-zone set-up and we think 2-zone is crucial for almost anything you are grilling. Most gas grills come with more than one burner nowadays because the concept of indirect cooking is becoming better known. When shopping for a gas grill, the more burners the better. Two is the minimum, three is better, four is best. You will appreciate the real estate and the ability to control temperature. Since law requires gas grills to have open vents, none of them allow you to control airflow, so there isn't a real significant difference between gas grills when it comes to smoking.

2-Zone Setup On A Gas Grill



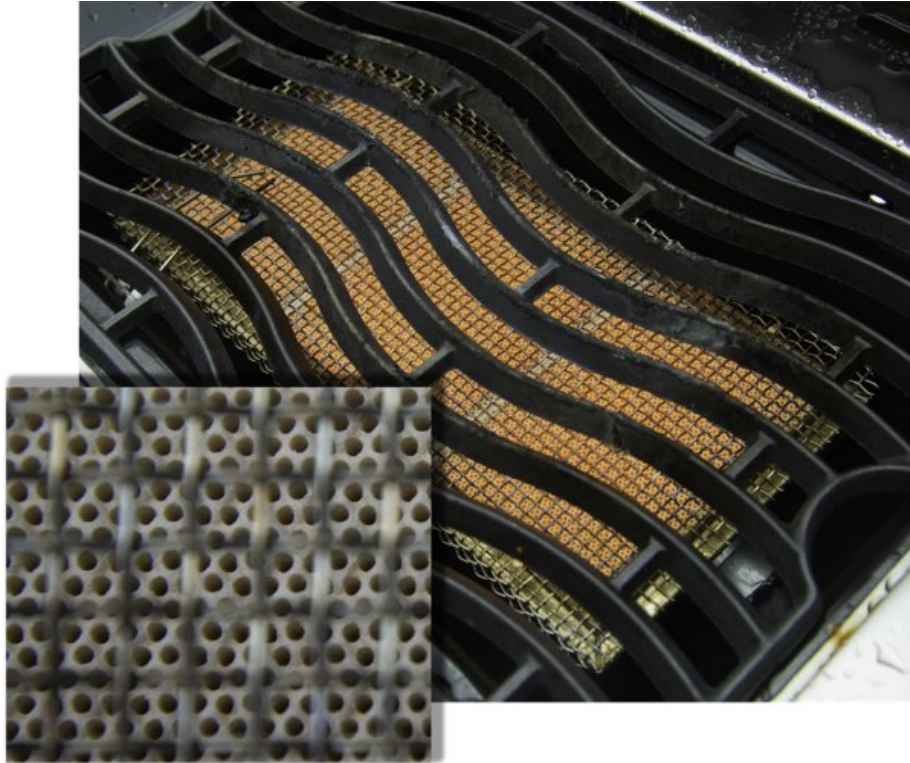
If you have a grill with only one burner, or if you have more meat than will fit in the indirect zone, try this technique. Put the wood as close to the flame as possible.



Regardless of how many burners you have, if you are going to smoke, put a pan of water between the burner and the food. The water absorbs heat and helps minimize fluctuations in temperature. The moisture also mixes with the smoke and propane combustion gases and creates flavors you cannot get with smoke alone. It also condenses on the meat cooling it and making a sticky surface for smoke to stick to.

The big difference among gas grills is their ability to sear at high temperatures. Unfortunately, most gassers just don't generate enough IR to do a great job of searing. A few come with sear burner tubes, but even they are usually anemic.

The best sear burners are made of ceramic honeycombs like this one:



For a propane grill, make sure you always have a spare tank. Don't risk running out. Natural gas grills never run out because they are connected to the household gas supply.

Now that you have set up your grill for indirect cooking, throw some wood on the flames or the deflector right above the flames, place the meat as far from the heat source as possible, close the lid, and let the convection airflow, smoke, and seasoning do their jobs!

[Click here for a look at our top rated gas grills.](#)

SMOKERS

Steak likes a little smoke but not a lot. So usually we don't smoke them.

But if you want to, the best way to smoke is a dedicated smoker, but it is not hard to convince a charcoal or gas grill to do it very well, thank you. There are many different types of smokers ranging from about \$200 to \$20,000+. Selecting one is a whole 'nother book so let us refer you to [some articles and videos](#) on AmazingRibs.com, and our [searchable database of hundreds of smokers](#) tested by the world's only full-time grill and smoker tester, our very own Max Good. (We don't sell anything, but we do link you to places to buy.)

Most smokers cook food entirely with indirect convection airflow. The fire is away from the food. A few smokers use direct heat but the coals are kept at a distance.

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smoker tester, our very own Max Good. (We don't sell anything, but we do link you to places to buy.)



If you are just getting started and have a limited budget, we recommend the charcoal burning [Pit Barrel Cooker](#) (above) for about \$350 delivered to your door fully assembled and ready to go.



The 18 inch Weber Smokey Mountain (above) is another great choice for about \$330.

An excellent choice, but a bit more expensive, would be one of the many high-tech pellet smokers with precision digital temperature controls. They burn small pure sawdust pellets about the diameter of a pencil and function as thermostatically controlled outdoor ovens with smoke. Just set the temperature and walk away.



Small portable pellet smokers start at about \$400, and full-size smokers about the size of a gas grill start at about \$700. We gave high marks to the [Grilla Silverbac Alpha](#) (below).



[Here's a list of all our top-rated pellet smoker models.](#)

For the very best smoke flavor, [we are partial to log burners.](#) The good ones are not cheap. They start at about \$800, so please don't be suckered into buying the cheap offset smokers at the big box hardware stores. Beware, log burners require constant tending and skill. Beginners will make mistakes and ruin a few meals. Below is a Lang reverse-flow offset smoker which is highly recommended. [Click here to learn more about offset smokers.](#)



The odd looking thing below is a [Karubecue](#). It employs a number of brilliant innovations that make it the best

backyard log burner on the market. It costs about \$1,440 at press time.



There are gas smokers and we like them because you can set em and forget em. They don't require the vigilance that charcoal and log burners demand. And they are inexpensive. Alas, some make temp control difficult, so be sure to check our reviews before buying.

There are electric smokers, but the wood smolders and does not burn in them. Burning wood produces better tasting smoke than smoldering wood so for that reason we are not fans of electric smokers.

Looking for a new outdoor cooking rig? Here's a web page with a lot of info, videos, and links on how to select a grill or smoker.

ABOUT WOOD



Then there is smoke, which we think of as a spice or flavoring element. Some of it comes from charcoal (gas has no flavor), some of it comes from vaporized drippings of juices, fat, and spices. But the best smoke flavor comes from burning wood.

Charcoal is not a very good source of smoke. When you first light charcoal it produces an acrid smoke. When it is fully ignited and has a thin coat of white ash, charcoal produces very little smoke. That is when you add real wood.

The best smoker is a dedicated smoker, but it is not hard to convince a charcoal or gas grill to do it very well, thank you. All you need to do is use a 2-zone set-up and throw hardwood, fruitwood, or nutwood on the flames and let it burn. That's right, let it catch fire and burn. You won't see a lot of smoke, but that's what you want. The truth is that billowing white smoke from smoldering wood does not taste as good as "blue smoke," smoke whose particles are so small they don't diffract much light, so the smoke is thin, pale blue, and practically invisible. Those flames you see are combusting impurities that impart undesirable flavors. So let it burn!

Never use any kind of pine or sappy, soft wood unless you want meat that tastes like turpentine. Never use construction lumber because it is often treated with poisonous chemicals to discourage rot and termites.

Charcoal is not a good source of smoke. When you first light charcoal it produces an acrid smoke. When it is fully ignited and has a thin coat of white ash charcoal and produces little smoke. That is when you add real wood.

We don't care what you have read, there is no need to soak wood before adding it. First of all, wood doesn't absorb much water. That's why they build boats from wood! We have soaked wood and cut it open and the interior is bone dry.

There is only a little moisture captured on the surface. When we weigh wood soaked overnight it gains less than 5% of its original weight.

Secondly, all that billowy white smoke from smoked wood is really steam because the wood cannot combust until the water on the surface of the wood evaporates at 212°F. Then the wood can go up in temperature to 500°F+ where it can combust. At that point, it burns with a bright blue and orange flame, making clean blue smoke with few impurities.

Don't obsess over which wood to use . The differences are subtle and you should concentrate first on getting quality meat, trimming it, salting it, rubbing it, temperature control, and sauce management. Wood theory is a book length topic unto itself, so if you want to know more and learn why we tell you not to obsess over wood types, [click here to learn about combustion and the different kinds of wood and smoke](#).

Do not overdo it on the wood as too much can result in an overpowering ash flavor in your food. Go easy the first few cooks and add more as you gain experience.

On charcoal or gas cookers, start with 4 to 8 ounces by weight of [chunks, chips, or pellets](#) for a mild smoke flavor that complements the meat and seasoning without overwhelming. No matter how much food you are cooking, 8 ounces should be enough. You don't have to be precise, just measure it in some fashion so you have a baseline for your next cook. Then you can add or subtract if you wish.

THE ABCS OF FIRE EXTINGUISHERS

*A*lways keep a fire extinguisher near your grill, smoker, and in your kitchen. Water will only spread grease fires. The best extinguisher is rated ABC.

- **Class A** fire extinguishers are for paper, wood, cardboard, and most plastics.
- **Class B** fire extinguishers are for flammable liquids such as gasoline, kerosene, oil, and grease.
- **Class C** fire extinguishers are for electrical equipment and wiring.
- **Class D** fire extinguishers are for combustible metals including magnesium, titanium, potassium, sodium, and some other chemicals.
- **Class ABC** fire extinguishers can handle most everything except some class D materials. This is the one you want. Beware, they contain a yellow powder that can damage electrical devices.

COOK WITH A THERMOMETER, NOT A CLOCK

COOK WITH A THERMOMETER, NOT A CLOCK

Different cuts of meat vary significantly in tenderness, fat content, and collagen content. Some are best cooked hot and fast, some better cooked low and slow, and some must be cooked with a combination of hot and slow to reach their optimal taste and texture. [Click here to read an article on the subject of cooking temps](#) and info on how to get this food temperature guide with more than 80 benchmark temperatures.



Meatheads

AMAZINGRIBS.COM

FOOD TEMPERATURE GUIDE

"By far the leading resource for BBQ and grilling information" Forbes

Beef, Lamb, Venison, Duck Breasts (Steaks, Chops, Roasts) - USDA Minimum 145°F (63°C)		
Blue, "Pittsburgh"	110-120°F (43-49°C)	Dark purple, cool, stringy, slippery, slightly juicy
Rare	120-130°F (49-54°C)	Bright purple to red, warm, tender, juicy
CHEF TEMP Medium Rare	130-135°F (54-57°C)	Bright red, warm, tender, very juicy
Medium	135-145°F (57-63°C)	Deep pink, yielding, juicy
Medium Well	145-155°F (63-68°C)	Slight pink, some tan, firm, slightly fibrous, moist
Well Done	155°F (68°C) or more	Tan to brown, no pink, chewy, dry
Pork, Raw Ham, Veal (Steaks, Chops, Roasts) - USDA Minimum 145°F (63°C)		
Rare	120-130°F (49-54°C)	Pale pink center, warm, tender, slightly juicy
Medium Rare	130-135°F (54-57°C)	Creamy pink color, bouncy, very juicy
CHEF TEMP Medium	135-145°F (57-63°C)	Cream color, some pink, yielding, juicy
Medium Well	145-155°F (63-68°C)	Cream color, firm, slightly juicy
Well Done	155°F (68°C) or more	Cream color, tough, dry
Chicken, Turkey (Whole Or Ground), Including Stuffing - USDA Minimum 165°F (74°C)		
SV TEMP Medium Well	160-165°F (66-68°C)	Cream color white meat, pale tan dark meat, tender
CHEF TEMP Well Done	160°F (71°C)	Cream color white meat, pale tan dark meat, firm
Ground Meats & Raw Sausages - USDA Minimum 160°F (71°C)		
SV TEMP Medium	145°F (63°C)	
Grill or pan fry these risky meats to 160°F (71°C) and make them juicy by using a 20 to 30% fat blend		
Tuna - USDA Minimum 145°F (63°C)		
CHEF TEMP Rare	120-125°F (49-52°C)	Bright reddish purple
Other Fin Fish - USDA Minimum 145°F (63°C)		
CHEF TEMP Medium Rare	125-135°F (52-57°C)	Slightly translucent, flaky, tender
Lobster, Crabs, Crawfish, Shrimp, Scallops - USDA/CHEF/SV TEMP When opaque 131°F (55°C)		
Hams, Hot Dogs, Precooked Sausages - USDA Minimum 140°F (60°C)		
CHEF & SV TEMP Sausage	140°F (60°C) or more	Tender, juicy
BBQ/Roasted Ribs, Shoulders, Briskets, Legs, Rumps - USDA Minimum 145°F (63°C)		
CHEF TEMP Tender, Tugs Apart	202°F (90°C)	High in fat and collagen, best cooked low and slow
Clams, Oysters, Mussels - USDA/CHEF/SV TEMP when shells open		
Leftovers - USDA/CHEF/SV TEMP Minimum 165°F (74°C)		

Other Useful Temperatures

- 0°F (-18°C) Best freezer temperature.
- 23°F (-4°C) Best freezer.
- 32°F (0°C) Freezer.
- 34-38°F (1-4°C) Best refrigerator temperatures.
- 130-135°F (54-57°C) Minimum time, most meats are most tender and juicy.
- 131°F (55°C) Most pathogenic bacteria begin to die. Minimum safe cook temp.
- 133°F (57°C) Connective tissues begin to contract and squeeze out joint juice.
- 150-165°F (60-74°C) Large cuts of low temps stall and do not rise for hours.
- 160°F (71°C) Soft-boiled eggs.
- 160-165°F (71-74°C) Instant kill zone. Most pathogens die in seconds.
- 160-200°F (71-96°C) Collagen melt, form gelatin, making meat succulent.
- 170-180°F (77-82°C) Cornish begins to set.
- 173°F (78°C) Alcohol begins to boil.
- 180-185°F (82-85°C) Wine begins to simmer.
- 185°F (85°C) Cornish begins to broil.
- 190-200°F (87-93°C) Most breads are done baking.
- 210°F (100°C) Baked potatoes are fluffy.
- 212°F (103°C) Sea level boiling point. Salts out 2°F every 1000' above.
- 225°F (107°C) Best temp for low & slow roasting (high cuts of meat) - X.
- 310°F (154°C) Baked brownies completely done.
- 325°F (163°C) Minimum cooking time for broiling poultry skin.
- 425°F (208°C) Before thermometer cables can melt.
- 450°F (232°C) Before pans can emit toxic gases.
- 500-700°F (260-390°C) Hardwoods start to smoke.
- 700-1000°F (390-538°C) Hardwood gases produce flames.

Fats & Oils

- 95-130°F (35-54°C) Animal fats start to soften and melt.
- 300°F (149°C) Butter starts to smoke.
- 325-375°F (163-191°C) Extra virgin olive oil begins to smoke.
- 350-375°F (177-191°C) Best oil temp for most deep frying.
- 361°F (183°C) Some animal fats begin to smoke.
- 370°F (188°C) Lard begins to smoke.
- 375-400°F (190-200°C) Virgin avocado oil begins to smoke.
- 390°F (199°C) Grapeseed oil begins to smoke.
- 400°F (204°C) Canola oil begins to smoke.
- 400-450°F (200-230°C) Hempseed oil begins to smoke.
- 440°F (222°C) Sesame oil and sunflower oil begin to smoke.
- 450°F (232°C) Peanut oil, corn oil, soybean oil begin to smoke.
- 482°F (250°C) Olive begins to smoke.
- 510°F (266°C) Safflower oil begins to smoke.

Soy/M

- 217-222°F (103-106°C) Larger temp for meat joints and joints.
- 230-234°F (110-112°C) Toned Stage. Some (table sugar) melt and make syrup. Fructose starts to caramelize.
- 235-240°F (113-116°C) Firm Ball Stage. For caramels.
- 244-250°F (118-121°C) Soft Ball Stage. For fudge, puddings.
- 290-295°F (121-130°C) Hard Ball Stage. For taffy.
- 270-290°F (130-142°C) Soft Cook Stage. For nougat.
- 300-310°F (149-154°C) Hard Cook Stage. For britches, ballpops.
- 320-350°F (160-177°C) Clear Liquid Stage. Caramelization.
- 350°F (177°C) Hard Super Stage. Starts to burn and tastes bitter.

SOUS VIDE (SV) RULES OF THUMB

These times and temps are starting points that will produce meats that please. Experiment!

A - TENDER CUTS

- 1 - Cook. Salt, then sous vide for 24 hours at the temp or less.
- 2 - Optional. Chill thoroughly in the bag.
- 3 - Rub. Remove from bag, pat dry, sprinkle generously with salt-free rub or lightly with salted rub.
- 4 - Finish. Sear in a hot pan, griddle, or on a grill until you like it, or smoke at 225°F (107°C) and then sear. Bring to the temp of left. Glaze or sauce if you wish.

B - TOUGH CUTS

- 1 - Cook. Salt, then sous vide at 145°F (63°C) for about 24 hours.
- 2 - Optional. Chill thoroughly in the bag.
- 3 - Rub. Remove from bag, pat dry, sprinkle generously with salt-free rub or lightly with salted rub.
- 4 - Roast or smoke. Roast or smoke at 225°F (107°C) until 145-155°F (63-68°C).
- 5 - Optional. Thoroughly dry the surface. Sear in a hot pan, griddle or on a grill. Glaze or sauce if you wish.

For ratings and reviews of more than 150 accurate, inexpensive digital thermometers and BBQ thermocouples visit AmazingRibs.com/thermometers

Much more info on Meatheads.AmazingRibs.com Version 5.8 Copyright © 2020

This is why cooking times in recipes are guesstimates at best. Think about the absurdity of a recipe that says, "cook the steak for six minutes on the first side and then four minutes on the second side." How long it takes to cook depends on how hot the air is, how hot the cooking surface is, how thick the meat is, and your target temp.

Depending on the grill, cooking steaks could take twice as long or half as long. Thick steaks take more time, and if you want them rare, they'll take less time than if you want them well done. [Click here for more on cooking times and what controls them.](#)

[You cannot tell if meat is safe or cooked to the proper temp by looking at it.](#) When you cut into meat to look at it, it can change in a few minutes after it has been exposed to oxygen. Compounds in marinades and brines can impact color. Sometimes vegetables in the grill can produce gases that alter meat color. It has long been thought that when chicken juices run clear the meat is safe, but modern chicken farming has changed that. Click here to [read how we bust the myth of clear chicken juices.](#)

The truth is, meat can go from succulent to sucky in just a few minutes. The only way to be sure about doneness is to use a digital thermometer. Overcook meat and you've wasted your money. Undercook it, and you could give someone a tummy ache or much worse. That is why you ALWAYS cook with a thermometer, not a clock. This is the 21st century. The digital age. Stop using 19th century technology. Ditch your dial telephone and your dial thermometer.



And while you are at it, get a digital oven thermometer. The cheap dial thermometer that came on your grill or smoker is probably off by 25 to 50°F like the one above. I have seen them off by 100°F!

[Click this link for a buying guide to thermometers with more than 150 test results from our on-staff electrical engineer.](#)

As the internal temp of meat climbs, more water gets squeezed out, and the meat becomes drier. In general, most meats are juiciest when cooked to medium rare, 130 to 135°F internal temperature.

But that's not hot enough for safety in some meats. Ground meats and poultry are health risks at those temps. Ground meats need to be cooked to 160°F, and poultry needs to go to 165°F to kill pathogenic bacteria. But there's more to the story than that. You can actually serve these meats at lower temps if you know the rules. **[Read my article on meat temperatures.](#)**

Meats with a lot of connective tissue such as beef and pork ribs, pork shoulder, and beef brisket, are too tough at these lower temps. They need to go up to 200 to 205°F in order to gelatinize collagens and melt fats. That's well past well done, and yes, water is lost, but the gelatin and melted fats lube the meat and make it taste tender and juicy.

Be aware that if you let meat sit around after you remove it from the heat, the heat built up in the outer layers will push down to the center and overcook the meat, a process called **[carryover cooking](#)**. The good news is that **[resting meat](#)**

is probably not necessary, despite what all the TV chefs say. For more about ideal serving temps, read my detailed Food Temperature Guide, which has a handy printout for your fridge.

A good digital thermometer is the most important tool you can own. As for monitoring and maintaining the desired grill/smoker temperature, the built-in thermometers are generally worthless. They are called bi-metal thermometers and most are slow and inaccurate. To become master of your instrument, you need a good *digital* oven thermometer to measure the air temp.



You also want a thermometer that can measure food temperature in 5 seconds or less. Here is the Thermoworks Dot for about \$40, the best all-purpose thermometer going for the price. It can be clipped to the cooking grates to measure oven air temperature, inserted into meat to provide constant readings throughout a long cook, or inserted in meat for rapid spot readings. For other options, go to AmazingRibs.com and click on Ratings & Reviews and then thermometers. We have an electrical engineer equipped with

special equipment to measure accuracy and speed. He has tested and reviewed hundreds.

They range from \$20 to \$200 and can have as many as six probes. Several have two monitors, one attached to a probe on a cable like the Dot And the other that it talks to with wireless tech so you can carry a monitor in your pocket while you cut the lawn or watch the game. There are even thermostats that can control the temperature of your charcoal grill.

SOUS VIDE QUE



The ultimate solution to preventing dry meat is cooking with a technique called *sous vide* and then finishing it on the grill. We call this *sous vide que* and we discuss this marvelous method, with videos [on this page on our website](#). For a Deep Dive on the subject, we have written an ebook called [“Sous Vide Que Made Easy: How To Deliciously Marry The Grill And Smoker With Sous Vide”](#).

When cooking sous vide you first salt the meat then put it in a plastic bag, squeeze the air out of the bag, and submerge it in water that is heated with an “immersion circulator.” It can hold the temperature precisely and consistently at, let’s say, 131°F for red meats and 154°F for poultry. You wait for the center of the meat to reach the target temp, and hold it there long enough to make it tender and pasteurized, about two hours. It is impossible to overcook this way.

The problem with sous vide is that, although the meat comes out tender and juicy, red meat surface is ugly grey and poultry the skin is flabby and bland. That's where the "Que" comes in. You finish it by adding the rub and placing the meat over a hot grill for a few minutes to create the Maillard reaction crust and flavors of browning. Another option after the sous vide step is to put the meat in a smoker at 225-325°F for 30 minutes. The results are extremely tender and tasty.

ADDITIONAL TOOLS

In addition to the smoker/grill and fuel, there are a few other tools that you will want to have on hand before you start cooking, including:

TONGS

These [12-inch tongs from OXO](#) make it simple to move chicken parts around your grill. They also lock closed for easy storage.



A SILICONE SAUCE BRUSH

When it comes to saucing, bristle brushes are really hard to clean and can harbor pathogenic bacteria. Throw them out and get [a good silicone sauce brush](#). They are easy to clean, they're dishwasher safe, and they load up with a lot of sauce.



A GOOD CUTTING BOARD

We are partial to plastic cutting boards because they can be cleaned in the dishwasher and if they get gouged you can sand them smooth. This [double sided one from OXO](#) has grips so it doesn't slide around on the counter and gutters along the edges to capture juices. It is under \$20.



A FILLET KNIFE

These cheapo [filleting knives from Rapala](#) are beloved by fishermen. They have thin flexible blades with a dangerously sharp edge and a wicked sharp tip and soft handle. The 9-inch model costs less than \$30. It's great for separating ribs, slicing tomatoes, removing silverskin/membrane on meat, boning, slicing the ribs and seeds out of hot peppers, and, of course, filleting. It is not strong enough for cutting through bone, but there is nothing better for cutting meat *off* the bone. When it is dirty, it goes in the dishwasher. When it's

dull, we sharpen it. When we can't get it as sharp as new, we get a new one.



A RIB HOLDER

If you are hosting Fourth of July and have a crowd coming and limited grill space, a [wire rib holder like this one](#) for less than \$20 can handle five slabs. Just beware, because the slabs are close together airflow and smoke-flow are hampered, so cooking time can be significantly longer.



18-INCH WIDE HEAVY DUTY ALUMINUM FOIL

Essential if you opt for the Texas crutch. We prefer it to butcher paper because it is easier to get a good seal.



A LOUNGE CHAIR

Once you settle into a [La Fuma lounge chair](#) or one of its imitators, you will not want to get up.



A SIX-PACK OF BEER

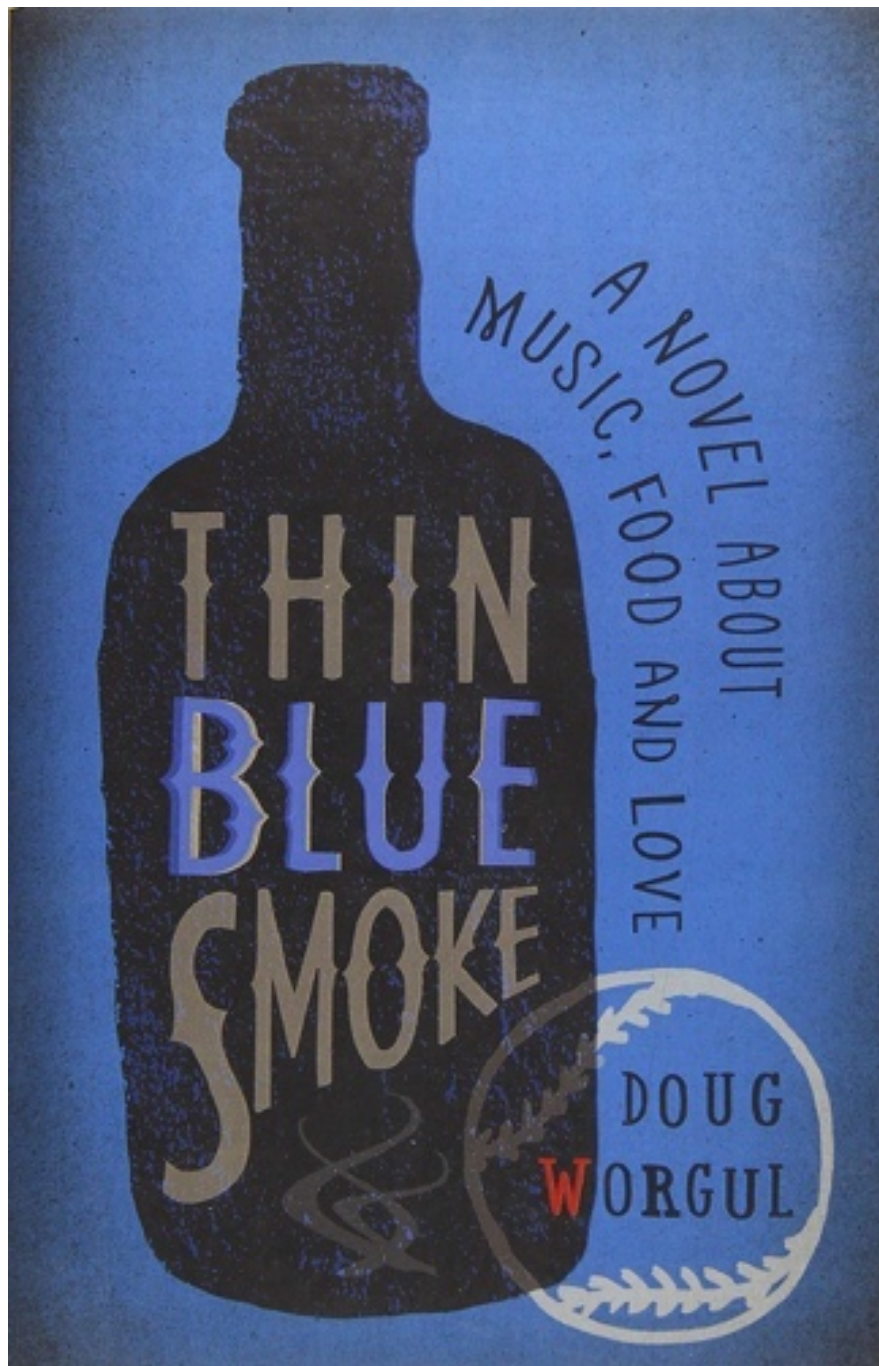
For the cook, not the meat.



A GOOD BOOK

A darn good read, *Thin Blue Smoke: A Novel About Music, Food, And Love by Doug Worgul* is well worth your attention. And not just because it has barbecue at its core. *Thin Blue Smoke* comes to life with some fascinating characters whose stories intersect with those of the main character, LaVerne Williams, a former major league baseball player who has an attitude, a rap sheet, and a Kansas City barbecue joint called “Smoke Meat.” The writer, Doug Worgul, has a day job as marketing director for one of the nation’s best barbecue joints, Joe’s Kansas City Bar-B-Que in KC, so this storyteller knows the turf. In Worgul's hands, the travails of a small-

time black restaurateur in the barbecue capital of the world ring true. Of course, Worgul's tale also weaves in music, whiskey, religion, profanity, love, lies, and laughter.



TUNES

Start with the great Louis Armstrong's "Struttin With Some Barbecue" (it's not really about barbecue, [click here to read the backstory](#)). To get you in the groove, we have a playlist of our favorite [food tunes](#).



PART VI

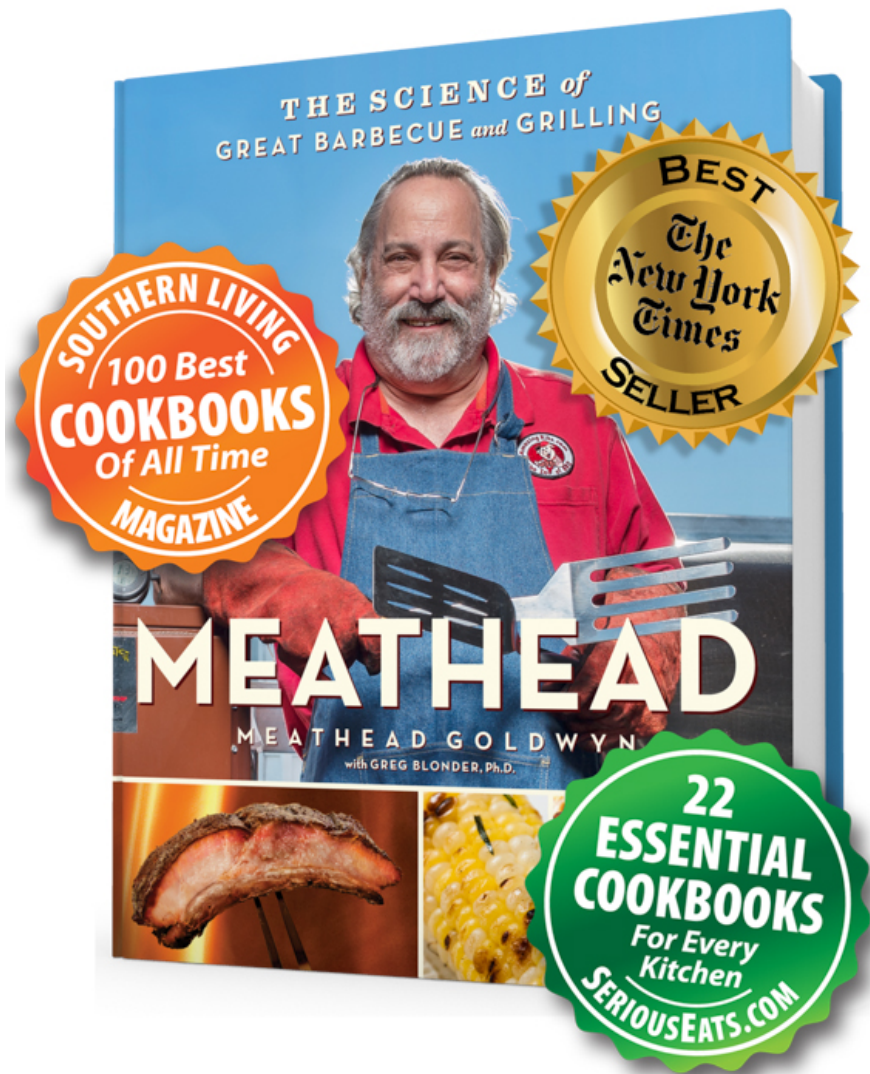
THE MEATHEAD METHOD

“Always remember, cooking for others is an act of love, and the most important part of the meal is not what's on the plate, but who's in the chairs.”

— *MEATHEAD*

Just what the heck is the Meathead Method?

It is the melding of science and art to create deliciousness and to nourish the soul as well as the body. It is a suite of science-based techniques that form the toolbox with which you can elevate your cooking, and hopefully gain creative inspiration.



I am honored that my hardbound book, *Meathead, The Science Of Great Barbecue And Grilling*, made a lot of best cookbook lists including “The 100 Best Cookbooks of All Time” by Southern Living and that many cooks now employ my concepts. The reason for the accolades is simple, for years I have been questioning conventional wisdom and testing what I call “Old Husbands’ Tales.” When the lessons I have learned are woven together they comprise a comprehensive philosophy and approach to culinary arts

that have form The Meathead Method. I believe the Meathead Method can change your life like it changed mine.

I have written about the Meathead Method on Meathead's AmazingRibs.com, but the web is not the best learning environment. A morsel of info here, click, jump, a snack there, click, jump a crumb next. A book, or in this case, two books, with a beginning, middle, and end is a far better way to get the big picture.

I am currently writing my next hardbound book not surprisingly named *The Meathead Method, Barbecue Science Meets Culinary Art*. I am very pleased with its progress. Be sure to [subscribe to my email newsletter](#) to hear about it when it is published.

BEEF GRADES

“The only time to eat diet food is while you're waiting for the steak to cook.”

— JULIA CHILD

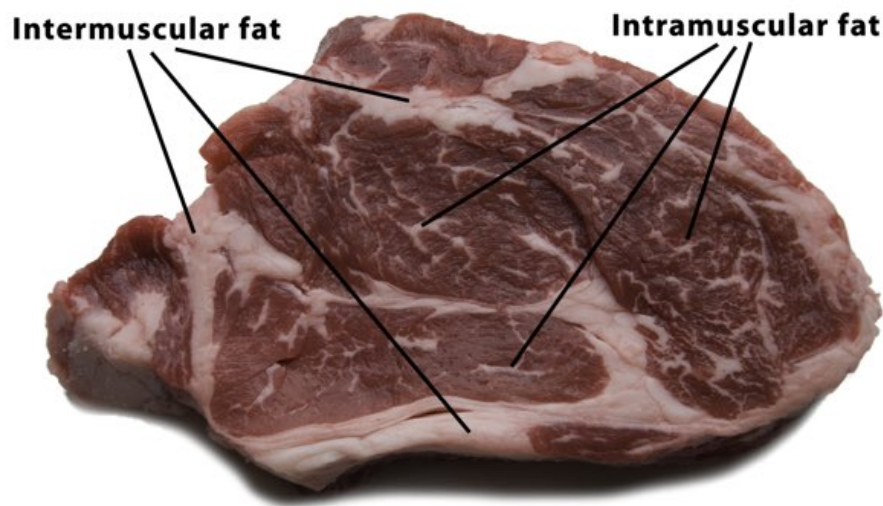
Chefs (and engineers) have a saying: "Garbage in, garbage out." That means if you buy less expensive, lower quality ingredients, no amount of seasoning or cooking is going to elevate them to the next level on the plate. It's like polishing a turd. There's only so much you can do. Steak greatness begins with the grade and cut of meat itself. If you want to cook a great steak, start with a great steak. Get the best quality meat you can afford.

Beef comes from both steers (boys) and heifers (girls), and the best comes from mature, but not old cattle. Most steaks on the market come from cattle 2 1/2 to 3 1/2 years old. The more an animal's muscle is worked, the bigger and more complex the meat's flavor becomes. Young animals (calves) are used for veal which is pale in color, and the meat tends to

taste very mild. The muscles of older, tougher cattle are dark and are best used for ground beef.

MARBLING

In 1926, the USDA began grading beef. Today, inspectors grade primarily on the age of the animal and the amount of fat *mixed in with the muscle* as measured between the 12th and 13th rib. This *intramuscular fat* is called *marbling* because it resembles the striations in marble: thin, weblike filigrees. The more marbling, the more flavor and juiciness. Marbling can contribute a lot to the quality of a steak because fat is where the flavor's at. *Subcutaneous fat* on the surface of the cut and thick fat veins between muscles called *intermuscular fat* do not influence flavor.



According to the AmazingRibs.com beef scientist, [Dr. Antonio Mata](#), "Marbling is the most expensive fat the animal generates. Like humans, cattle first deposit fat in the

gut. Secondly they deposit subcutaneous/surface fat. Then they deposit fat between muscles, *intermuscular fat*. And lastly they deposit *intramuscular fat*, a.k.a. marbling. Marbling is a highly inefficient, slow, expensive process." And we pay for it. Highly marbled meat also shrinks more when cooked as the fat drips off. And we pay for that too.

Harold McGee, eminent food scientist and author of our kitchen Bible, [On Food and Cooking: The Science and Lore of the Kitchen](#), has written that much more than marbling influences quality. "Despite the prestige of Prime beef, the current consensus among meat scientists is that fat marbling accounts for no more than a third of the variation in the overall tenderness, juiciness, and flavor of cooked beef. The other important factors include breed, exercise and feed, animal age, conditions during slaughter, extent of post-slaughter aging, and storage conditions before sale."

[Carrie Oliver](#) of the Artisan Beef Institute believes there are other criteria, including use of drugs and other husbandry conditions, transportation, as well as cutting techniques. We might add freshness, seasoning, and cooking are also highly important quality factors. Marbling impacts juiciness and mouthfeel, and if you get a good sear it can have a major impact on flavor.



The US Department of Agriculture (USDA) has a long list of standards for cattle, including many terms that appear on butcher labels. It pays to know these terms when you shop.



Choice



Prime





Wagyu



Kobe From Japan



Prime Dry Aged 30 Days

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Above are boneless ribeye steaks. You can see how **Wagyu** has more marbling than **Prime**, which has more marbling than **Choice**. You can also see that the **Dry Aged** steak is darker and smaller because it has dehydrated.

[Dr. Mata](#) says, "There is significant variation between muscles within the same grade. The *Serratus ventralis* (Denver cut) and *Infraspinatus* (flat iron) are significantly higher in fat than the *Longissimus dorsi* (ribeye and strip)."

All the steaks pictured above (except the Kobe) came from [Allen Brothers](#), a first rate Chicago butcher that supplies many top steak houses, including Morton's, Lawry's, and Delmonico's. They also sell superlative beef to

consumers online, as do [Porter Road](#), [Snake River Farms](#), and [Crowd Cow](#).

For reference, here's a quick rundown of all steak grades as defined by the USDA.

USDA Utility, Cutter, Canner Beef. These are the lowest grades of beef and used primarily by processors for soups, canned chili, sloppy Joe's, etc. You will not likely see them in a grocery.

USDA Standard or Commercial Beef. Practically devoid of marbling. If it does not have a grade on the label, it is probably standard or commercial. These grades are fine for stewed or ground meat, but they are a bad choice for steaks on the grill. About 2% fat.

USDA Select Beef. Slight marbling, as shown in the photo above of strip steaks. If you know what you are doing you can make this stuff tender. Otherwise, get a higher grade. About 2 to 4% fat.

USDA Choice Beef. Noticeable marbling, but not a lot. This is a good option for backyard cooks. About half of all beef is graded USDA Choice. There are actually three numbered sublevels of USDA Choice. Certified Angus Beef (CAB) is limited to only the top two levels. Reliable sources tell us that Walmart "Choice Premium" is USDA Choice. The word "premium" is all about marketing and not to be confused with USDA Prime. Choice beef has 4 to 10% fat. A 12 ounce ribeye typically sells for about \$8 to 10 retail at the time of this writing in 2020, and prices fluctuate depending on

supply and demand as well as weather, which impacts the cost of feed.

USDA Prime Beef. Significant "starry night" marbling. Often from younger, more tender cattle. Prime is definitely better tasting and more tender than Choice. Only about 3% of the beef sold is prime and it is usually reserved for the restaurant trade. About 10 to 13% fat, about \$20 to 30 for a 12 ounce ribeye at retail. A dry aged steak can be 15 to 18% fat and \$30 to \$35 or more for a 12 ounce ribeye.

Black Angus. After arriving in the US in the 1800s, Black Angus became the country's most common cattle breed. Black Angus has a reputation for being especially well-marbled and flavorful. Alas, it is almost impossible to know if what you are buying is really Angus. Other popular US beef cattle breeds include Red Angus, Charloais and Hereford.

Certified Angus Beef. The Certified Angus Beef (CAB) brand is a trademarked brand designed to market quality beef. To wear the CAB logo, the carcass is supposed to pass 10 quality control standards and CAB must be either USDA Prime or one of the two upper sublevels of USDA Choice. Most of it is USDA Choice. CAB costs a bit more because the American Angus Association charges a fee to "certify" the cattle and higher markups take place on down the line.

Interestingly, CAB does not actually certify that the beef labeled Certified Angus Beef is from the highly regarded Angus breed. Their major control is that the cattle must have a black hide, which is a genetic indicator that there are Angus genes in the cattle, but not a guarantee.



American Wagyu Beef. American Wagyu cattle have Japanese blood lines and are raised in the US and other countries. Their genetic heritage can be any number of Japanese cattle breeds. American Wagyu does not have to adhere to the same standards as Kobe beef (below), and many of the American Wagyu are crossbred to make them better adapted to the local climates and diseases. Wagyu and Angus (Wangus) crosses are frequent, and they make mighty fine meat. American Wagyu is usually extremely marbled, more than USDA Prime, but not as much as Japanese Wagyu, and the flavor and texture is distinctive. It is also about twice the price of USDA Prime. One can only wonder how long before the cross breeding and lack of enforceable standards dilute the quality.



If you want to try some amazing real American Wagyu, we have links to top suppliers on [our artisan foods page](#). That's a cross section of a Snake River Farms Wagyu flat iron steak above. The meat is simply remarkable, shot through with thin wisps of buttery marbling. Go for the ribeye or striploin. Do not die without having tasted great American Wagyu. Steaks can run up to 30% fat and \$60 to 70 for a 12 ounce ribeye.

That said, we do not recommend buying American Wagyu hamburger which is essentially pre-chewed meat, and which might have non-Wagyu fat in the blend. But if you're after

the big bucks in a barbecue or steak competition, beware, the guy next to you is using American Wagyu.

BUSTING THE KOBE BEEF MYTH

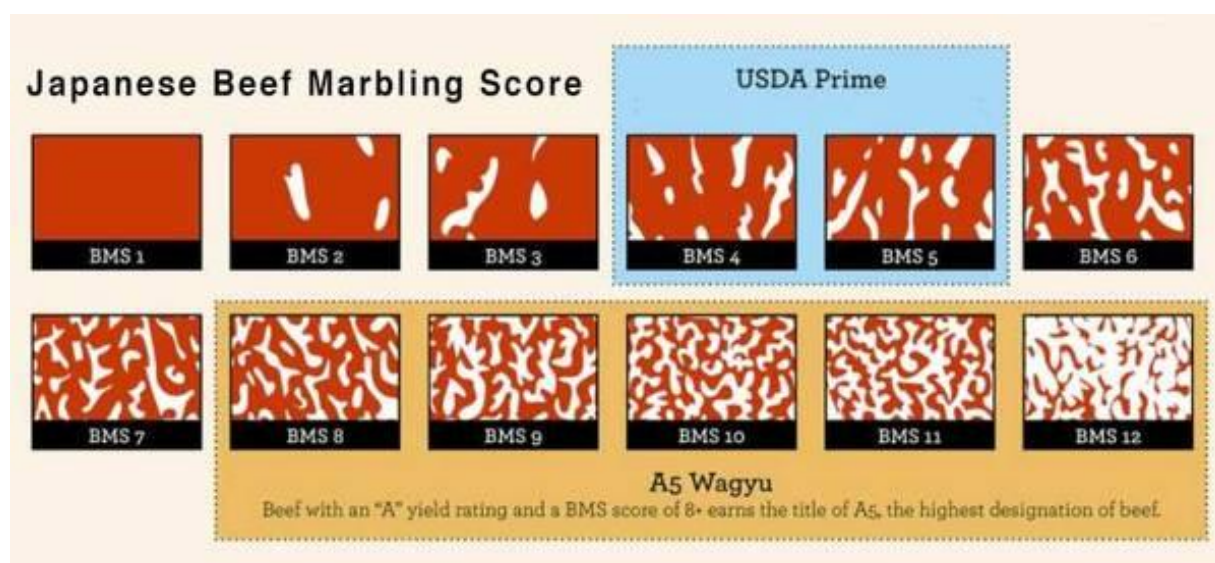
Japan is famous for highly marbled fabulously expensive beef, most notably the mythical Kobe. "Kobe Beef" is a trademarked brand name administered by the [Kobe Beef Marketing & Distribution Promotion Association](#). They oversee producers, slaughterhouses, distributors, retailers, and restaurants who use the name in Japan. There are numerous regulations controlling when the name can be used, not the least of which is that the steer must be born, raised, and slaughtered in Hyogo prefecture (a prefecture is like a state), and fed a specified diet. A 12 ounce ribeye costs well over \$150 retail. That is not a typo.

There are four bloodlines of special rare fatted Japanese beef. As a group, they are all called *Wagyu* (it translates roughly to mean "Japanese cow"). They have a high ratio of fat to muscle and are revered for flavor, tenderness, and most of all, the richness that comes from the chemistry of the fat, which practically melts in your mouth like butter. They are not to be confused with American Wagyu, described above.

Kuroge Washu (Japanese Black) is one of the four bloodlines and it accounts for about 90% of specialty Japanese beef. It has several sub breeds, **the most important of which is Tajima**. Villages that grow Tajima according to rigid regimens name their beef after their origins, like European

wines. Kobe is the most famous village, Omi is another, and Matsusaka is another.

In Japan, meat is graded A1 to A5 with A5 having the most internal fat. These five grades are broken down into 12 grades with a Beef Marbling Score (BMS). USDA Prime is 4 to 5 BMS (10 to 13% fat), while American Wagyu is usually 4 to 10 BMS, and Kobe and the other Kuroge Washu steers can go up to 12 BMS (more than 50% fat) because of their genetics, feed, and handling. Mostly genetics.



Kobe are fed mostly grain and sometimes mash left over from making sake and beer. Despite what you may have read, they are not fed beer. Nor are they massaged. A few may be massaged by loving owners paying for their children's college, but it is not a normal part of their cultivation. Today, there are about 4,000 cattle slaughtered each year for Kobe beef, a pittance. 90% of all Kobe is consumed in Japan.

Until late 2012, Japanese beef was not allowed into the US. Until then, everything labeled Kobe was falsely labeled. Fake. Fraudulent. Phony. Bogus. Disgraceful. It was probably American Wagyu at best. If you think you have tasted Kobe, chances are you have not. All Kobe is sold as boneless, so if you think that T-bone you had in Vegas was Kobe, it was not. And there are no Kobe burgers being sold in the US. If you know a restaurant that advertised Kobe beef prior to mid 2012, then they are likely selling mislabeled fish, too. Run. Even today, it is highly unlikely that a restaurant in the US or Canada advertising Kobe is selling the real deal. Last we checked in November 2017, only two dozen restaurants in the US carry the real thing. And because they are less known, anything labeled Kuroge Washu, Tajima, Matsusaka, or Omi is even scarcer. But you can occasionally order Kuroge Washu in the US from select importers. We buy ours from [Crowd Cow](#).

Some analogies. Champagne is a region in France. A "Champagne" from California is similar, could even be better, but it is not real Champagne and it is usually not even made from the same grapes. Idaho potatoes come only from Idaho, not France or Japan. Could you imagine the lawsuits if they grew potatoes in Japan and called them Idaho potatoes? Parmigiano-Reggiano is the real parmesan and it comes only from the area around Parma and Reggio Emilia in Italy, never from a green toilet paper tube. Maine lobster looks and tastes different than Florida lobster. Florida lobsters have no claws. You'd be rather upset if you ordered Maine lobster and received one without claws. In these cases, there is more to it

than just a name. Real Kobe is truly different than any other meat in the world.

Here is how to cook Kobe beef. The fat content and texture is close to pork belly or bacon. It is far too rich to just choke down a whole ribeye. We plan on about 4 ounces per person. We serve it as an appetizer before a vegetarian meal. Usually a big salad. You could even serve it on top of a big salad, but you don't want to bury it with a salad dressing. After tasting this, you will not want any more meat and besides, serving more meat would be pointless. Begin by thawing it. Get a black cast iron pan or griddle screaming hot. As hot as possible. Black will sear it better than stainless but some people recommend stainless. Beware, it can make the pan very hard to clean. You do not need to oil the pan, the fat will melt rapidly. We recommend that you do not cook the whole steak at once. Cut it into 1 inch strips. Toss the meat on the heat and cook it long enough to get a dark brown surface, perhaps 3 to 4 minutes per side. You might want to cut a strip and test the timing before you start production. It is too thin to use a thermometer on. After you flip it, sprinkle some salt on the top. Sit down to eat so you don't collapse in a dead faint.

WHERE TO GET GREAT BEEF

You can buy prime beef, aged beef, or Wagyu beef, but only higher-end markets and specialty butchers have it. If you can't find it in stores, order it online. We have recommendations of suppliers on [our artisan foods page](#).

OTHER BEEF TERMS

G **Grass Fed Beef.** Until the 1950s, most US beef was grass fed right up to slaughter by being allowed to graze on open ranges. As the US population grew and demand for cheap beef grew, especially with the advent of fast food hamburger chains, corn feeding became the norm. Now there is a trend back to grass feeding because many believe it is better for the animals, for people who eat them, and the environment. When used on meat labels, the term “grass-fed” means that the animal ate only grasses and forage such as hay for its entire life after weaning. The grass-fed label is regulated by the USDA’s Food Safety and Inspection Service. Some people think 100% grass-fed beef tastes better than grain fed, but more think corn fed tastes best. There is a difference in taste. Grass fed beef can have a mineral quality. It can be very distinctive and have more personality than corn fed and many people, especially old timers raised on grass fed love it. Alas, many people aren't charmed by its personality.

Grain or Corn Finished. Most cattle are raised on grasses including hay most of their life. But for a few weeks before

slaughter they are fed corn or other grains. This “finishing” of cattle on grain or corn helps them reach a marketable weight and gives the meat more marbling, a higher USDA grade, and a higher price. Most US beef is corn or grain finished, so unless you see “grass-fed” on the label, your beef has been corn fed for at least part of its life.

Organic Beef. USDA rules passed in 2002 state that certified organic beef must be produced according to strict rules that must be verified with an elaborate paper trail on every animal including its breed, feed, and medical history. To be certified organic it must eat only organic grasses and grains, have unrestricted outdoor access, must never be given antibiotics or hormones, and must be treated humanely. Some physicians and scientists think giving cattle antibiotics could be encouraging the appearance of antibiotic resistant microorganisms in humans. Organic beef is more expensive.

Natural Beef. Natural beef must not be given antibiotics or hormones, but they can be grown, fed and handled in the same way as other common cattle.

Kosher Beef and Halal Beef. These cattle are grown and slaughtered according to Jewish law (kosher) or Muslim law (Halal). Their requirements are similar. Both require that the animal be slaughtered by slitting the animal's neck veins and drained of practically all blood. Some experts believe this method is painful and inhumane, and in response some forms of stunning are currently accepted.

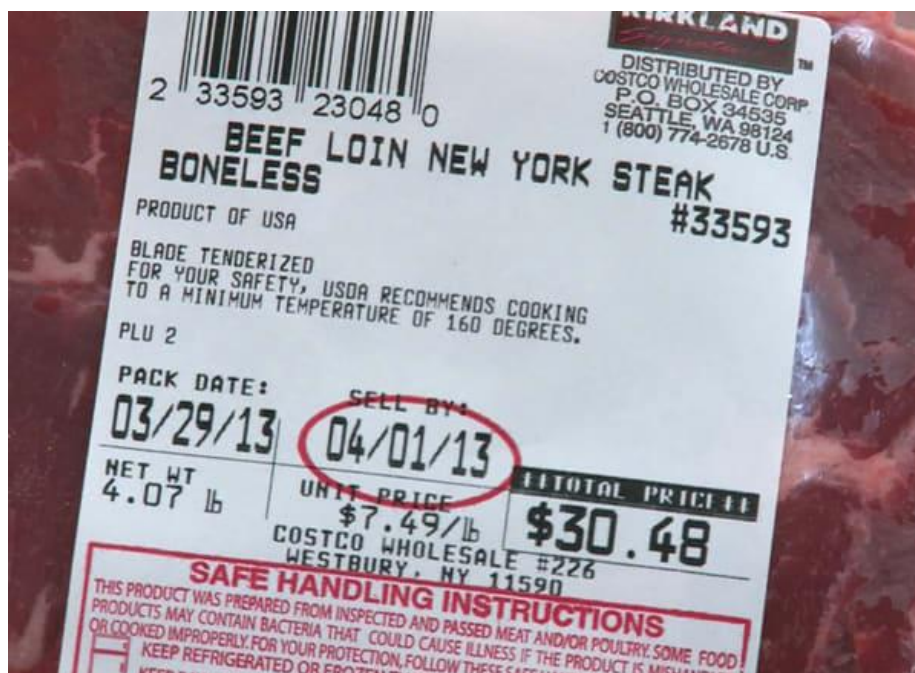
ABOUT THAT ROSY COLOR

If that ribeye at the grocery store is looking rosy and delicious, that's because it's really fresh, right? Well, maybe not.

It seems that Cargill and others have perfected a process for sealing meat in an airtight pack with a carbon monoxide atmosphere, and that keeps the meat from oxidizing and turning brown. For a long time. Even if it is stored improperly.

Seems that even fresh meat can brown easily, and still taste just fine, but shoppers will buy the pink meat first even if it is not fresh. So grocers, who are cutting back on their butchering staff and hate wasting unsold meat, have turned to "modified atmosphere" pre-packaged beef, lamb, and tuna.

Consumer groups are fighting to have the stuff labeled, but the industry is resisting.



So the color of steaks in a package is not a good measure of freshness anymore. Check the sell by date! Of course health inspectors can all tell you tales about butchers changing meat labels to extend the sell by date.

The solution? Get to know your butcher and stay on your toes.

BEWARE OF BLADE TENDERIZED BEEF



Some meat suppliers try to tenderize beef by using a device called a blade tenderizer. It is a series of thin sharp blades or needles that stab the meat and cut through tough fibers and connective tissues. Above is a picture of a home version called a *jaccard*. Commercial versions are motorized and much larger. They work, but they are also high risk.

Beef pathogens, like dangerous strains of *E. coli*, are common on the surface of meat, but they are killed almost instantly when cooked. But if the meat has been blade tenderized, these bacteria can be pushed down into the center of the meat which often is not cooked enough to kill them.

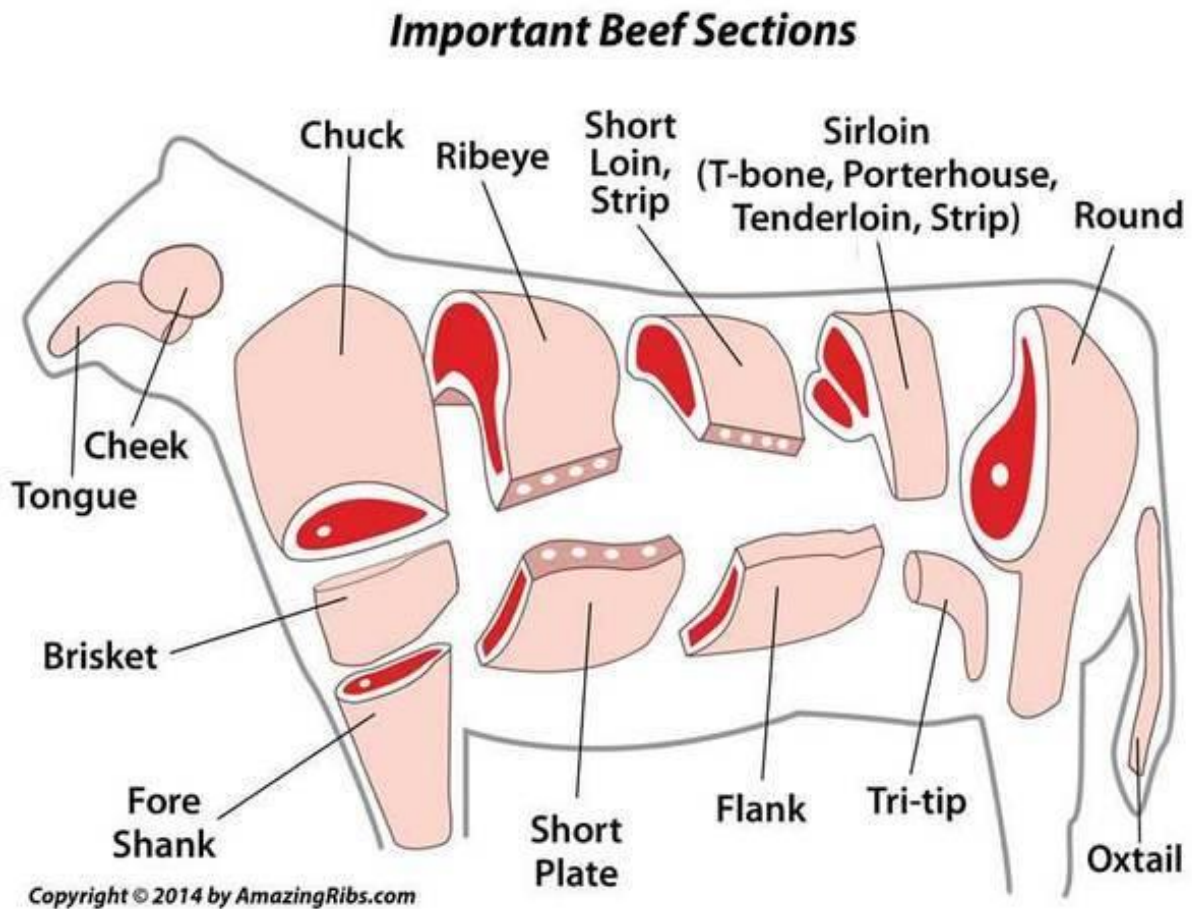
According to the Centers for Disease Control and Prevention, between 2003 and 2009, blade tenderized beef caused 174 illnesses *that we know of*, and one person died. It is estimated that for every case reported, there may be 20 or more cases unreported.

You cannot tell by looking at meat if it has been mechanically tenderized, although sometimes you will see it mentioned on the package. Most steaks sold at Costco under their Kirkland brand are "blade tenderized" and, thankfully, they say so on the label (check the picture). The USDA is trying to pass regulations requiring all meat that is blade or needle tenderized to be labeled as such, but it's being held up by the bureaucracy.

Check the label. If it doesn't say "blade tenderized" but does say to cook the meat to 160°F, it's been needled. Of course, we do NOT recommend cooking any steaks to 160°F, which is well past well done. You might as well serve leather shoes instead.

Incidentally, meat labeled organic is allowed to be blade tenderized.

WHICH CUT OF STEAK IS BEST?



Which cut should you buy? Well, what's the occasion? If it's Valentine's Day, you might want

a filet mignon (and some lobster for surf and turf. [Check out our recipe here!](#)). Or if you're having a casual backyard get together, a flank steak or two will feed a crowd. Just you on a Tuesday night? Steakhouses tend to serve the most tender cuts, usually from the area along the spine of the steer: ribeyes, porterhouses, T-bones, strip steaks, and cuts from the tenderloin such as the chateaubriand and filet mignon. These are the most expensive cuts. But you can also make darn tasty steaks from the sirloin, round, flank, and other cuts, even though those muscles are not as tender. When in doubt, we tend to go for ribeye. It's the best cut for both flavor and tenderness.

Some argue in favor of the strip steak, but that is the same muscle as the ribeye, the *longissimus dorsi*, so that argument is like debating which side of *Abbey Road* is better. A lot of folks prefer meat from the tenderloin because it is more tender, but tenderloins are also leaner than ribeyes, so they don't have the flavor that fat brings to the party. Let's take a closer look at steak cuts and what makes one steak "a cut above" another.

Bovines have been a part of human life for thousands of years. The ancestors of cattle and bison, named aurochs, can be seen on paintings of cave walls in Europe. We have used bovines for centuries to pull plows, for their hides, for milk and cheese, and their flesh for food.

It is a safe bet that it didn't take early humans long to determine that different muscles in the carcass had different characteristics. Some were tender, some tough, some juicy, some fatty, some rich in flavor, some bland.

Nowadays most steers and heifers live on farms eating grass and hay until they are about 15 months of age. Then they are sold to huge feed lots where they stay for about four months and are fed grain, mostly a type of high calorie corn flake, and vitamins and medicines, often including antibiotics, for about four months. According to the AmazingRibs.com beef scientist, [Dr. Antonio Mata](#), "Bovines are like humans. When they consume a lot of calories they accumulate fat. First belly fat, then subcutaneous fat, then fat between the muscles, and finally intramuscular fat, which is marbling. The process is very inefficient but produces huge quantities of tasty beef at relatively low cost."

On the other hand, the process has come under a great deal of criticism for a number of issues including arguments that the method is inhumane; that the antibiotics are not killing all the bacteria and the ones that survive are antibiotic resistant, and that means that humans can no longer rely on antibiotics when they get sick; that corn subsidies are making beef artificially cheap; that these large Concentrated Animal Feeding Operations (CAFOs) create a massive environmental hazard with unmanageable quantities of waste chief among them.

More and more cattle are being finished on farms on grass rather than grain, where the manure fertilizes the grass they eventually eat. The resulting meat is more expensive, often chewier, and tastes different, with a mineral character that Meathead remembers from his youth, before CAFOs.

Some disdain the taste, some love it. Mata says "grasses vary greatly. Alfalfa hay for example, can produce beef with

plenty of marbling and superb flavor. Some of the best beef I've tasted has been fed primarily alfalfa. On the other hand, winter grasses produce beef with a limited amount of marbling and depending on the grass, sometimes there is a fish-like flavor. Just like beef cuts, not all grasses are created equal, and most produce marginal tasting beef."

We love the taste of both grass finished and corn finished meats, and we hope to discuss the political and economic issues in depth in the future. Suffice it to say that we have read extensively on the subject, and we agree that corn subsidies, CAFOs, and antibiotic overuse are serious issues and there may be viable alternatives, but the impact of these other systems will certainly mean more expensive beef. Many of us can afford pricier beef, but many, especially those who depend on cheap ground beef, would face hardship or a major lifestyle change.

HOW MUCH TO BUY

Finally a simple question! Here's a simple answer: Plan on 12 to 16 ounces per adult for bone-in steaks and 8 to 12 ounces per adult for boneless steaks. There will be trim and drip loss. If there are leftovers, they can make an appearance on a sandwich or salad the next night.

BEEF PRIMALS AND THE CUTS THEY CONTAIN

For centuries, animals were slaughtered and broken down by the town butcher and by restaurants close to where they were grown, and there was no label consistency from one

butcher to the next. In 1865, immediately after the Civil War, the Union Stockyards in Chicago became a central distribution point for shipping live animals. In 1880 Gustavus Swift, a large meat processor, introduced a rail car that was well insulated, cooled by ice, and designed so that the shifting weight of hanging sides and quarters would not derail the car. The cold meat could stay fresh for days and be distributed to remote locations, like Miami, where they would be broken down by local butchers and restaurants. But the cuts and labels were still inconsistent.



This changed in War World II when the government standardized on "primal cuts" and corresponding nomenclature. There were seven primals: Chuck, rib, loin, round, short plate, shank and brisket, and flank. Some of these primals were further segmented into sub-primals: The loin is composed of the short loin and the sirloin sub-primals.

In the 1960s a major change was pioneered by Iowa Beef Processors, called "boxed beef". They removed many bones and a significant amount of fat at the slaughterhouse, then placed the cuts in sterile shrink wrapped plastic bags without oxygen, and packed them in boxes of the same cut. Without oxygen and chilled or frozen, the meat was safe from microbial spoilage and oxidation. Pork and other meat packers followed shortly.

Despite these innovations and attempts at standards, butchers long ago began excavating the carcass and named the cuts of meat, muscles, and groups of muscles they discovered. The jargon is confusing to this day. There are more than 50 common cuts in the US, and some go by multiple names. Some have been confused for so long that nobody can say for sure what a Delmonico or London broil really are. To add to the confusion, the cuts and names are different around the world, even in English speaking countries. Today the North American Meat Processors book, The NAMP Meat Buyer's Guide, has become the standard by which butchers cut their meats so a chuck roll is the same coast to coast (see sidebar). It is the definitive argument ender.

In April 2013, The Beef Checkoff Program, the National Pork Board, and the United States Department of Agriculture (USDA) agreed to new labeling standards in an attempt to "make things easier on the consumer". In many cases it has made things more confusing. [Click here to see a pdf of all the new beef names and the old ones side by side.](#)

In general, the cuts that come off the primals can be classified as (1) roasts, which are large thick muscle groups that can feed at least four people, (2) steaks, individual servings that are flat and perfect for grilling, (3) stew meat, chunks cut from odd shaped pieces, and (4) ground meat or hamburger, from scraps.

I have linked many of the cuts to recipes. Recipes for steaks are below in the recipes section. When it comes to ribeyes, strip steaks, T-bones, porterhouses and most other steaks, the methods/recipes remain the same. Ditto for roasts.



RIB PRIMAL OR RIBEYE (ABOUT 10% OF THE MEAT ON A STEER)

Here's where the best meat on the steer is found. It's also the most expensive. The main muscle is the loin muscle, or the *longissimus dorsi* which runs from between the 2nd and 3rd rib from within the chuck (shoulder) all the way through the sirloin to the hip bone. It is the longest muscle on the animal. There is one on either side of the spine, and each one sits right at the top of the animal.

The rib primal begins between the 5th and 6th rib and ends between the 12th and 13th rib. Well marbled ribeye steaks are the first choice of connoisseurs, prime rib roast is the ultimate feast for friends and family, and the little known rib cap, the spinalis dorsi, is the best muscle on the animal. These cuts have a perfect balance of muscle and intramuscular fat to produce optimal flavor and juiciness.

Beef ribs come in two sections, the curved back ribs from near the spine, and the straighter, meatier short ribs, from the side, which start here and continue into the short plate and even into the chuck.

Roasts

- Prime rib roast

Steaks

- Ribeye steak (recipes below)
- Cowboy ribeye steak
- Eye of ribeye steak/Crown steak
- Rib cap steak

Ribs

- Back ribs
- Short ribs



LOIN (SHORT LOIN & SIRLOIN 17%)

Here's a section that can challenge the rib primal for primacy when cooked properly. Again, the main muscle is the *longissimus dorsi* muscle. The *longissimus* has many popular names in the loin section: Strip steak, New York strip, Kansas City strip, shell steak, loin, and strip loin.

The other main muscle in this primal is the tenderloin, or *psoas major*. This is the muscle from which filet mignon and chateaubriand is cut.

Strip is marbled and mouth coating, tenderloin has little fat and is the most tender muscle on the steer. Delightfully, the two come together in T-bone and porterhouse steaks.

The T-bone and porterhouse are similar looking steaks with the two muscles separated by a T-shaped section of backbone. One side of the T has a large section of loin and the other has a small section of tenderloin. The difference between the porterhouse and T-bone is the size of tenderloin. Because the tenderloin tapers like a baseball bat toward the shoulders of the animal and the T-bone is further to the front of the animal, the tenderloin portion on a T-bone steak is smaller than on the porterhouse, a minimum of 1/2 inch wide at the T. On the porterhouse, the tenderloin portion must be a minimum of 1 1/4 inches wide, but it can be up to 3 inches wide as you move to the rear.

Sometimes tenderloin/filets are left on the T-shaped bone, sometimes they are removed. Ditto for the loin. Interestingly, porterhouse is getting hard to find because the animals are getting so big that a 1 inch steak can weigh a whopping 25 ounces. Word to the wise: tri-tip is the poor man's tenderloin, and strip loin roasts can be just as good as prime ribs.

Roasts

- [Strip loin roast](#)

- Tenderloin roast
- Chateaubriand roast
- Tri-tip roast
- Ball tip roast
- Top sirloin roast
- Top sirloin butt roast
- Coulotte roast
- Petite sirloin roast

Steaks (recipes below)

- Strip steak
- T-bone steak
- Porterhouse steak
- Sirloin steaks
- Coulotte or picanha (top sirloin) steak
- Filet of sirloin
- Hanger steak
- Petite sirloin steak
- Bavette steak

Other

- Bottom sirloin flap meat
- Stew meat
- Ground sirloin
- Tenderloin tips
- Flap



ROUND (23%)

The hind legs put in a lot of work pushing around 1,000 pounds or so of beast and thus produce ornery cuts of meat. There are some roasts here that must be slow cooked and cut thin, there is plenty of stew meat, abundant hamburger, and a few steaks that beg for reverse searing: Start them low and slow, and sear just before serving.

Roasts

- Rump roast
- Top inside round roast
- Bottom outside round roast
- Eye of round roast
- Knuckle (a.k.a. sirloin tip)

Steaks

- London broil
- Eye of round steak
- Round steak
- Top round steak
- Merlot steak
- Western steak

Other

- Hind shank
- Stew meat
- Ground round



CHUCK (30%)

The sturdy chuck shoulders a great deal of weight and is a tangled mass of muscles, sinew, and fat. Many impressive roasts and steaks come from the shoulder, and some fine stew meat, not to mention most of the best burgers. At the rear of the chuck, where it connects to the rib primal, there are about two steaks called chuck eyes that are practically the same as the vaunted ribeye, only a lot cheaper.

Roasts

- Chuck roast
- Shoulder clod roast
- Chuck roll roast
- Chuck eye roast
- Petite tender roast
- Arm roast
- Denver roast
- Ranch roast

Steaks

- Chuck eye steak
- Petite tender steak
- Flat iron steak
- Top blade steak
- Ranch steak
- Denver cut steak

- Mock tender steaks
- Las Vegas strip steak
- Sierra steak
- Teres major

Other

- Ground chuck
- Stew meat
- Shoulder tender medallions
- Country style chuck ribs
- Chuck short ribs



BRISKET (6%)

This boneless mass from the chest contains two major muscles, including the pectorals, along with a thick fat cap, and it is tough as nails unless cooked low and slow. That's why it is braised in every Jewish household, or smoke roasted in every Texas barbecue joint. And on St. Patrick's Day cured brisket, a.k.a. corned beef, is simmered with cabbage. Take a slab of corned beef, give it the right rub, smoke it, and you may have the most sublime taste on the steer: pastrami.

Roasts

- Whole packer brisket
- Brisket flat

- Brisket point



SHORT PLATE (6%)

Rife with marbling and layers of fat, this is the meat on top of the rib bones on the side: They are tough but rich. If cooked gently for a long time, as in a braise of wine and spices, or in air filled with smoke, these cuts turn into the ultimate comfort food. Chefs are discovering that there are some fancy burgers in there too.

Steaks

- Skirt steak (see below)
- Hanger steak

Other

- Short plate
- Short ribs



FORE SHANK (4%)

A gnarly and knotty knot of twisted muscles and tendons, this is meat best for long slow braises and for soups.

Other

- Foreshank
- Shank cross cut



FLANK (4%)

Rich in beefy flavor, this flap of meat is a poor man's ribeye when given a quick searing char. But beware, it has long fibers that must be cut across the grain, and cut thin, to give up the goods.

Steaks

- Flank steak



OFFAL & OTHER CUTS

Italians call these meats the "quinto quarto" or the fifth quarter. Not popular in the US, they are very common in other countries.

- Heart
- Liver
- Kidneys
- Cheeks
- Tongue
- Brains
- Sweetbreads

- Tripe
- Stomach
- Ox tail



TENDERNESS OR FLAVOR?

When shopping for steaks, the cuts that have the most marbling, the most flecks of fat mixed in with the muscle fibers, will be the most flavorful. The muscles on the animal that don't work a lot and don't produce as much fat and sinew will yield the most tender steaks. For example, the tenderloin is the most tender cut, and among the most expensive, but it is not the most tasty because it is very lean. The harder working muscles are often more flavorful, but they are tougher. If you love flavor, you can combat the chewiness by proper cooking, usually by reverse sear.

MOST TENDER CUTS (LOWER NUMBERS MORE TENDER)

Meat scientists measure tenderness by using devices that gauge the amount of force needed to shear the muscle. Here are the top ten "tender" and "tough" cuts in shear force from the National Beef Tenderness Survey. Shear force is shown as pounds of force to shear one-half-inch cores, removed parallel to the muscle fibers, of cooked muscle from steaks and roasts. Source: Morgan et al (1991).

1. Tenderloin steak 5.7

2. Top blade steak 6.7
3. Top loin steak 7.2
4. Rib roast 7.3
5. Rib steak 7.4
6. Ribeye steak 7.5
7. Chuck roll roast 7.6
8. Clod roast 7.9
9. Round tip roast 7.9
10. Top sirloin steak 8.0
11. Top 10 Toughest
12. Round tip steak 8.9
13. Bottom round roast 8.9
14. Chuck tender steak 9.0
15. Top round roast 9.0
16. Eye of round roast 9.2
17. Chuck roll steak 9.2
18. Rump roast 9.5
19. Bottom round steak 9.7
20. Eye of round steak 10.3
21. Top round steak 11.7

PICTURES OF SOME POPULAR CUTS



Boneless ribeye. Eye is in center, rib cap on the right and bottom. Click here for [steak cooking tips.](#)



Bone-in ribeye. Click here for [steak cooking tips.](#)



Eye of ribeye.



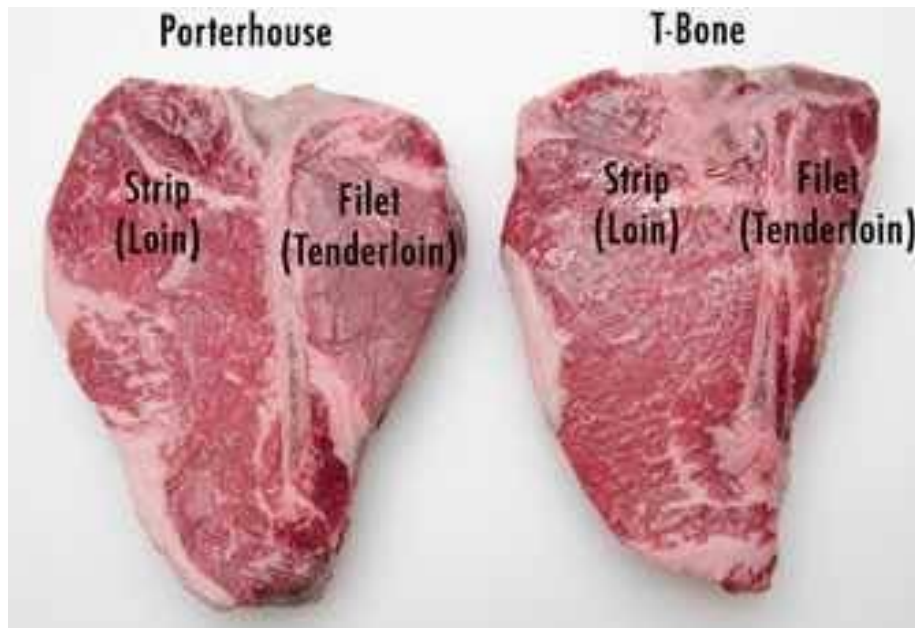
Rib cap from American Wagyu beef.



Chuck-eye. [Click here for our Grilled Drunk Chuck Steak Recipe more about the various cuts of chuck steaks.](#)



Cowboy ribeye, a.k.a. tomahawk ribeye



Porterhouse and T-Bone. Two of the most desirable steaks, and the largest and most expensive, the porterhouse and T-Bone both contain a T-shaped bone with a section of strip (a.k.a. loin, a.k.a. *longissimus dorsi*) on one side and filet (a.k.a. tenderloin, a.k.a. *psoas major*) on the other. The main difference between them is the size of the filet. The T-bone comes mostly from the short loin and the filet must be a minimum of 1/2 inch wide below the backbone (bottom of the T). The porterhouse is from the sirloin, and the filet must be at least 1 1/4 inches wide below the backbone. It can sometimes be as wide as 3 inches.



Bone-in strip steak.



Round/rump. This is the top of one of the rear legs, known whole as a Baron of Beef or Steamship Roast and often carved into individual cuts of roast beef at buffet stations. Several cuts, mostly roasts, also come from the round.



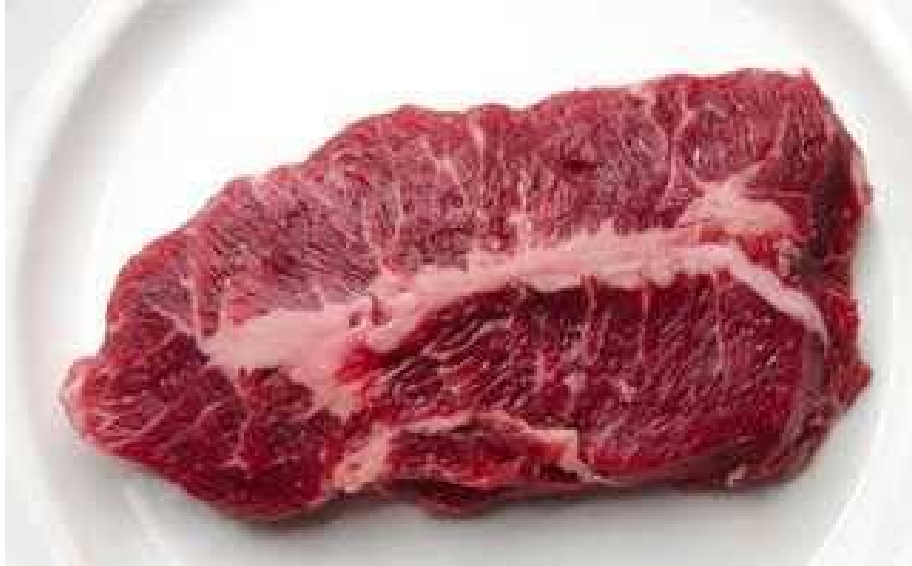
Flank steak.



Skirt steak (fajita steak).



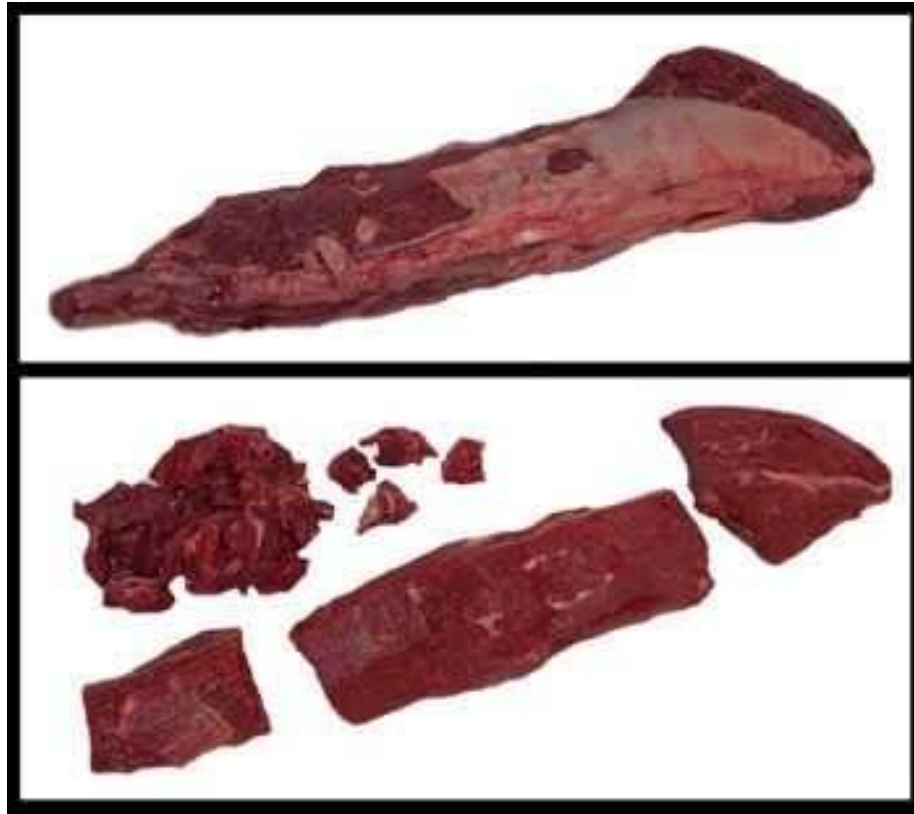
Las Vegas Strip Steak, from the chuck.



Top blade steak. From the chuck, the meat is flavorful and tender, but that strip of tendon is tough.



Flat iron. This is the muscle from above or below the tendon in the blade steak (previous picture). Below is the same piece of flat iron steak after cooking.



Whole tenderloin (top), butchered (bottom) into chateaubriand (center), two steaks, and stir fry meat.



Chateaubriand (from the center of the tenderloin).



Filets Mignon from the chateaubriand, in a mushroom cream sauce.



Coulotte (picanha). This is the top sirloin cap. It is a specialty of Brazilian steakhouses, photographed here at [Fogo de Chao](#) in Chicago, where it is rotisserieed and served with its fat cap, considered a delicacy.

For a highly technical interactive dissection of a bovine, visit the [University of Nebraska Bovine Myology pages](#).

AGING BEEF

“I must govern the clock, not be governed by it.”

— GOLDA MEIR

Should you buy aged steaks? In all likelihood, you already do. After cattle are slaughtered, a slew of chemical changes known collectively as *rigor mortis* makes the meat tough within the first 12 hours. This “green” beef must be chilled rapidly but not frozen, and it takes a couple of days for the muscles to relax enough to be sold. This usually happens in shipment. After that, the meat can be further aged, or ripened, to increase tenderness. Enzymes and oxygen begin to work on the meat during rigor and throughout the aging process, enhancing the flavor in most cases. Enzymes are “nanocooks” in the words of food scientist Harold McGee, and they do what a professional cook does when cooking beef: they break down the proteins, amino acids, and other compounds, creating new compounds, including glutamates, the source of the savoriness known as *umami*, which is the main flavor we

look for when eating steak. As the beef ages, more interesting flavors emerge, and that is what all the fuss is about. But you can't age beef by just throwing it in the fridge and waiting for it to get tender. Oxygen and bacteria can mess it up.

But too much age can spoil the meat, especially if bacteria, yeasts, or molds attack it. There is a big difference between aged meat and old meat. In addition, aging does not enhance all cuts, and it is not necessary for ground beef. Pork and most poultry do not age well at all because their fats get rancid more rapidly than those in beef. Here are some quick definitions of beef terms when it comes to aging.

Fresh beef. This seemingly desirable term means the meat has not been aged at all. Unlike fresh fruit, fresh is actually not a sign of the highest quality for beef. But not to worry. By the time the meat is butchered, packed, and shipped to the warehouse and then your grocer, it is no longer fresh.

WET AGING

At the slaughterhouse, meat is usually packed in plastic "cryovac" bags that have had most of the oxygen removed. If kept this way at 34 to 38°F for about 28 days, enzymes tenderize the meat, but the flavor is not changes as much as it is in dry aging. Meat rarely stays in the bag for more than 28 days. During that time, enzymes tenderize the muscle, but they have minimal impact on the taste of the meat. If you buy cryovacked meat, check the packing date and if you wish, you can store it in the fridge for up to 28 days from the

bagging date. Don't push it beyond that, though, and don't try to bag meat yourself. If there are bacteria on the meat or in the air; if there is oxygen in the bag; or if there is a leak in the bag (and there most definitely can be any or all of these), things can go south in a hurry. But just leaving the cryovacked meat in the fridge until day 28 gives enzymes more time to do their work. Brisket cooks swear that wet aging up to 28 days makes a difference in the tenderness of this tough cut. If you try it, one word of caution: when you open a cryovac bag, the meat often smells odd, some say like parmesan cheese. It is called the cryovac stink, and it usually dissipates within an hour.



DRY AGING

Dry aging beef is an expensive process for tenderizing beef and concentrating its flavor. Dry aged beef is noticeably different tasting than fresh beef because the chemistry of the fat changes drastically. Some describe it as nutty, some as gamey. Some ancient Egyptian royals were so fond of dry

aged beef they were buried with it ([click here to read about some dry aged beef ribs buried with the couple that loved it sooooo much](#)).



If you haven't tried it, you need to first taste dry-aged beef and decide if you like it. Start saving now: it ain't cheap. You can occasionally buy aged beef from specialty butchers, or you can do it our favorite way: get three friends and head to a restaurant that specializes in dry aged beef and do an expensive comparison tasting.

Aging works especially well on beef and bison, less well on other meats. It is not a good idea for pork, since pork fat goes rancid rapidly. It is rare to find dry aged beef in grocery stores because most of them buy their meat in vacuum packed plastic bags. Some specialty butchers and high end restaurants offer dry aged beef. Only a few fancy steakhouses and upscale butchers have aging rooms.



We have had aged beef often but a while ago we had the opportunity to do an aged steak tasting at the now closed David Burke's Primehouse with the chef at the time, [Chef Rick Gresh](#) (above). Alas, it has since closed. They bought all their Black Angus from the same farm, and the farmer raised

and fed the cattle the same way. Several team members from AmazingRibs.com attended, and together we tasted ribeyes aged 28, 45, 55, and 75 days.

All of the aged steaks were wonderful, but all very different. After 45 days, the flavor had changed so much that it no longer tasted like beef as we know it. It was as if the meat came from a different animal. Many of the changes in taste occur in the fat rather than the muscle. As for the texture, beyond 45 days, we were unable to notice much difference in tenderness. Our favorite was the 28 day steak because it had not yet gotten funky, but the flavors were concentrated and the meat was oh so tender. Others preferred the older meats, proving once again that taste is a matter of taste.

Will you like the taste of dry aged beef? The question is similar to: Which do you prefer, Mayo or Miracle Whip? Smooth or chunky? It's a personal preference. But there's one way to find out. Find a steakhouse that ages beef and taste it.

Dry aging is often referred to as controlled rotting because enzymes, molds, bacteria, and oxygen go to work on the meat. The exterior of the muscle gets dark purple and a small amount of moisture evaporates, shrinking the meat about 5% ([as Kenji Lopez-Alt explains, it is not the dramatic 20% shrinkage you may have heard about](#)).

As water evaporates, flavors concentrate, so the meat tastes more meaty. While water evaporates, fat does not, so the ratio of muscle to marbling changes. The meat becomes fattier overall. The higher the fat ratio, the richer and juicier

the meat feels in the mouth, proving once again that the juiciness sensation is caused by much more than the water content of the meat. Fat plays a significant role in juiciness.

Just before cooking dry aged beef, the outside crust is trimmed off, and the meat is sliced into steaks, so another 10 to 15% of the weight is lost. Can you see now why aged steaks are so expensive? The selling price is typically an additional \$1 per aging day on top of the normal price. And that's why it pays to age beef yourself at home. You pay only for the steak, not the aging (despite some loss in the total weight).

DO IT YOURSELF

Yes, you can dry age beef at home. It is tricky, but if you master the method you can save a lot of money. First, select high quality meat, at least USDA choice or USDA prime, preferably tightly wrapped in a vacuum pack cryovac bag. Fresh meat is best, but if you have frozen, Chef Gresh says it is important that you defrost the meat slowly in the fridge, not under running water, to help preserve its integrity. Next, get the right cuts. You want to start with a prime rib roast that weighs 20 pounds. Or a strip loin. Or a sirloin. No tenderloin. It is already very tender, it is low fat, and it can get mushy with age. These are expensive meats, so don't screw around or take shortcuts with the aging process. That's a lotta meat. But what you don't use right away after aging, you can freeze.

DON'T BOTHER AGING SINGLE STEAKS

Alton Brown of Good Eats on the Food Network likes the idea of aging single steaks and instructs us to "Wrap the steak in a single layer of paper towels and put on a cooling rack set inside a half sheet pan. Refrigerate 24 hours. Discard the paper towels, rewrap and return to the refrigerator, on the rack, for 3 days. Change the paper towels again if they become damp and stick to the steak. An hour before cooking, remove the steak from the refrigerator and remove the paper towels. Thirty minutes before cooking, sprinkle the steak on both sides with the kosher salt." We have tried it and, although we usually agree with AB, it was a heckuva lotta work for very little improvement. We're not sure there was any improvement.

HOW TO AGE BEEF AT HOME THE OLD FASHIONED WAY

There are five variables that you must control: Quality of meat, temperature, airflow, days of aging, and to a lesser extent, humidity. Some people use their kitchen fridge for aging beef. We don't recommend it. The door opens and closes, moist and warm air and microbes enter, and there are lingering smells in there that the meat will happily absorb. If there is any mold on the shelf from the time you spilled the milk or chicken juices or mold in the onion drawer, you likely will fail (remember: that meat is expensive!). It is best if you have a second fridge used just for aging meat. If you want to store some beer in there, OK, but make sure the bottles are clean. Make sure the fridge is clean. Turn it off,

wipe it down with soapy water, rinse, and rinse once more with a bleach solution made with one tablespoon of 5% unscented liquid chlorine bleach per gallon of clean water. Then air it out to get rid of the chlorine smell. Some folks buy a small [dorm refrigerator](#) or a [keg fridge](#) and dedicate it to this purpose.

The fridge should be kept at 34 to 38°F. Any lower than 32°F and the enzymes will go on strike. Above 40°F spoilage microbes can grow. Even if you aren't aging meat, your fridge should be set to 38°F max. It significantly reduces spoilage, even in comparison with 40°F. And, of course, you need a reliable thermometer. A dial thermometer is not reliable. Normally we recommend digital thermometers, but [a liquid bulb thermometer](#) is accurate enough for refrigerator temps.

Many experts believe humidity is critical with the ideal being 80 to 85%. Recent research says don't sweat it. According to a 2008 technical paper on Aging Beef by Professor Jeff W. Savell, PhD, of Texas A&M, "There are no published studies that have compared the effects of different relative humidity levels on dry-aged beef, and it appears the studies in this area have used a relative humidity of approximately 80% with a considerable range around that number."

Wash the outside of your sealed cryovac bag with soap and water before opening it. Then open it, drain off the liquid, and wearing gloves so you don't contaminate the meat, rinse off the slime and then pat the meat very dry. Leave the fat and bones in place: they will reduce evaporation during the aging process. After aging, you will want to remove them.

But for now, weigh the meat so you can calculate the weight loss.

Take a large pan wider and longer than the meat, and fill it with about 1/2 inch of salt. It doesn't matter what kind of salt. But salt is corrosive, so you do not want to use an aluminum pan. Stainless steel, glass, or porcelain pans are OK. The salt will absorb drips, moisture, and odors.

Put the meat on a wire rack, preferably stainless steel or coated with nickel or plastic, and place the racked meat on top of the salt pan so it sits above the salt. Don't use a roasting rack, which holds the meat below the walls of the pan. You want ample airflow all around the meat. If you don't have a suitable rack, you can put the meat on the (cleaned!) top rack of the fridge and put the salt pan on the rack below.

Ample airflow helps to move moisture away from the meat's surface. Professor Greg Blonder, the AmazingRibs.com science advisor, uses a fan from a dead computer and runs the cord between the door gasket and the door jamb. Meathead uses this 5 inch battery powered fan with an AC adapter. He threads the cord through the fridge door gasket on the hinge side and it does a fine job of keeping the air flowing and moving moisture off the meat. To help stabilize the fridge temp, put a few gallon jugs of water in fridge to chill. The cold jugs of water will help the fridge recover its temp after it has been opened and closed.

Some recipes call for wrapping the meat in cheesecloth, kitchen towels, or paper towels, and replacing them every

day. The idea is that the wrapping pulls moisture to the surface and helps wick it away. Don't bother with these shrouds. You want the meat fully exposed to dry air, not in contact with wet cloth.

The next step is the beauty of this technique: do nothing. Just let the meat age. And let it go for at least three weeks. Taste tests show minimal flavor changes in meat aged less than two weeks, but most people can taste subtle changes after three weeks. At about 28 days, flavor changes become more obvious. You can go longer, and you might want to push the envelope to see what age is your fave.

When you are ready to eat, there are two ways to go.

1) You can trim about 1/4 inch of the black crust and the bones off the entire slab. You'll need a sharp stiff bladed knife for this because the meat has dehydrated and will feel hard. An electric knife works fine. Throw out the trim, and cut what's left into steaks and roasts. Wrap everything in plastic. You can refrigerate the pieces you plan to eat within a day or three, and freeze the rest.

2) You can cut off only the amount you want to eat, trim that amount, and leave the rest of the slab to continue aging.

Now tuck in for a treat!

DRYBAG AGING

In recent years, a clever new product has come on the market, the [UMAi Dry](#) system. This company makes transparent bags in which you place meat and, with a

vacuum sealer, draw out the air and seal the bag. The UMAi material is not a conventional plastic, [as you can see here in a photo by Jaden Hair of SteamyKitchen.com](#). Moisture will not drip out, but it will evaporate out. [Research by a team from Kansas State University and Sweden](#) published in the journal *Meat Science* has shown that the bag's permeability does not create an anaerobic environment, so dangerous botulism bacteria cannot grow, and other microbes are too large to enter the bag. For this reason, the manufacturer claims, "If you want to dry age cleanly and safely in any refrigerator or cooler, excellent air flow and the application of UMAi material is the combination most likely to give you excellent results." As you can see, the process differs a bit from the old fashioned system where air and bacteria can contact the meat. Alas, not every vacuum sealer will work with the bags. The company sells its own sealers, and they are expensive. So is the bag material. We have not yet tested this product, but it's worth exploring if you plan to age beef regularly at home.

THE STEAKLOCKER

It's easiest to buy a small dorm-style fridge dedicated to the task of aging meat. Or you can invest \$1,449 in the [Steak Locker](#). It is temperature and humidity controlled with a carbon filter, a UV light to kill bacteria, and a glass door so you can watch your meat age. It even talks to your smartphone with readings of temp, humidity, and elapsed time. We have not tested it yet.

THE STEAKAGER

Another aging environment, the [SteakAger](#), has been in development a long time through crowdfunding. We strongly recommend you wait until we have had a chance to test it. The basic model is a roughly 1 foot square plastic box that fits inside your fridge. On top, it displays temperature, humidity, and a day counter. There is a clear plastic front, a fan, and a UV light to kill bacteria. It is small with a capacity of only 22 pounds, but that could be the right size for fans of dry aging beef at home. They also sell a larger and more expensive refrigerated version that has a 40 pound capacity.

Want a quicker, easier way to improve the flavor of your steak? Try dry brining, discussed in detail below.

BUTTER AGING

There's also an in-between type of aging that some chefs have experimented with recently. It's not quite wet-aging and not quite dry-aging. You let trimmed beef sit in the fridge for a couple days, then submerge it in a bath of softened butter, and let the butter-enrobed beef age in the fridge (34-38°F) for at least 30 days. Although the process appears to be closer to dry aging beef, the results are more similar to wet-aged. Why? Because there is little to no moisture evaporation due to the butter casing, so you don't get the concentration of flavor you get with dry aging. You do, however, get the tenderizing effects of enzymes working within the meat.

BONE-IN OR BONELESS?



*I*t is a common belief that bones make grilled and barbecued meat taste better. The shibboleth goes that bone-in ribeye is tastier than boneless, that bone-in pork shoulder makes better pulled pork than boneless, that

bone-in chicken breasts are more succulent than boneless, etc.

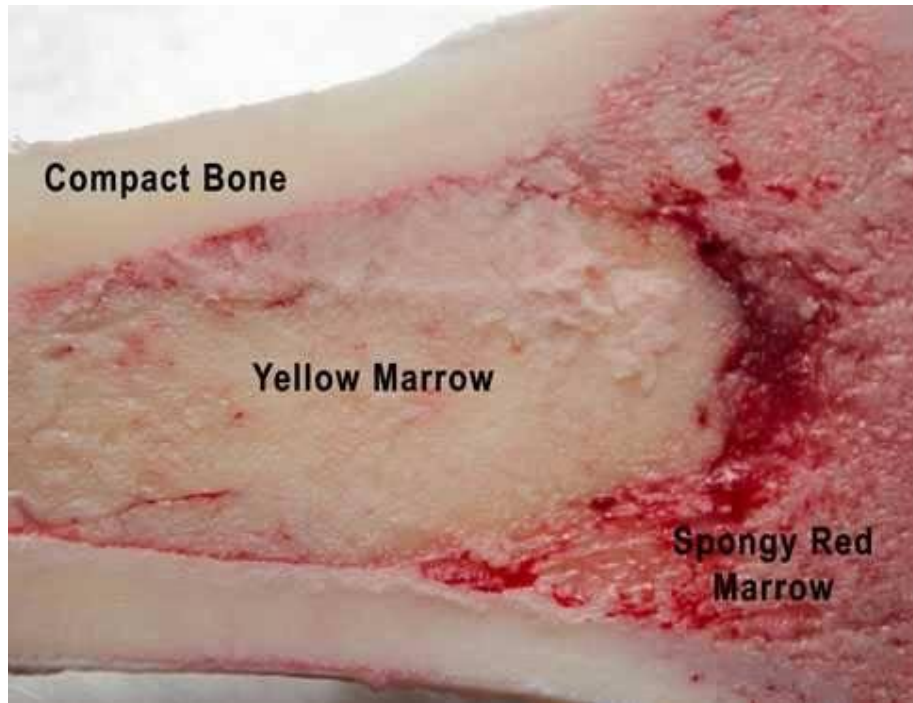
Myth.

On slabs of ribs, there is no question that the intercostal meat, the meat between the bones, is special. It is loaded with connective tissue that can gelatinize and become sweet and succulent. There is also a lot of fat marbling in there, and the old saw that "fat is flavor" is no myth. On poultry, the connective tissue between the ribs is often sucked and savored because it is so tasty and because, if you did it right, it has seasoning on it.

But what about steaks? What about the bone-in ribeye shown above or in T-Bones?

ANATOMY OF BONES

Bones are complex structures and they differ from species to species and location to location. In cattle, leg bones are different from neck bones or rib bones, etc. In chickens, leg bones are very different from rib bones. The differences are mostly in the function of the bone. Bones have important architectural functions. They are load bearing and protective. But there are some things that most bones have in common.



Bone exteriors. The exteriors are walls of calcium and other minerals called "compact bone" designed to bear loads and protect organs. The larger the animal, the thicker the compact bone. Obviously, bovine leg bones have much thicker calcium than chicken breast bones. Bone walls do not dissolve or melt during cooking. There are small channels running through the calcium to carry blood and nerves to and from the marrow, but in general, the calcium is not very porous so very little marrow can leak out during roasting or grilling, even under the pressure of heat.

Marrow. The marrows of bones are complex. [Dr. Antonio Mata](#) says that bone marrow can be broadly divided in two categories, red marrow and yellow marrow. "Red marrow is the hard honeycomb marrow that we have all seen in ribeyes, T-bones, and porterhouses because the bones are often cut open by a bandsaw," he says. "It can also be found

in the ends of bones." These highly porous marrows, also called spongy marrows, are home to stem cells that produce blood cells. That's why the ends of pork rib bones often turn black during cooking. Although almost all blood is drained from muscle tissue during slaughter (the pink liquid is a combination of the protein myoglobin and water, not blood), some blood can be trapped in bones. Yellow marrow is the type you find in the center of femurs and other leg bones. It is mostly fat. "You can eat it and it is orgasmic," says Mata ([click here to see a recipe for grill roasted marrow](#)). Cowboys call it prairie butter. We call it poor man's foie gras.



Connective tissue. Bones are surrounded by membranes of connective tissue that anchor muscle to them. This sheathing, we call it gristle, is mostly made of a protein called collagen which can partially turn to gelatin when heated to the right temp. Invisible collagen also surrounds muscle groups and fibers ([see our article on meat science](#)) and it is more tender in young animals than old. Gelatinized

collagen is a major contributor to the richness and mouthfeel of meat. You've seen it when you chill cooked meat, especially chicken. The juices solidify and form a gel called aspic. It is very different from fat. Taste it. This gelatin is pure essence of meat. There is a lot more connective tissue and fat between rib bones than any other muscle group, which explains why we love ribs so. But in a steak or roast or even a chicken breast, there is no way the gelatin can wriggle down through the muscle fibers and impact the flavor of a whole piece of meat. Meat is just not that porous.

THE COOKING METHOD MATTERS

In wet cooking methods, such as braising and in slow cookers, where the meat is submerged and simmered for hours in liquid, the marrow can dissolve and can have a major impact on the flavor of the liquid and the meat. Braising liquids are often made with wine and/or water, both solvents that help pull out the marrow. Marrow is a major reason ossobuco, braised veal shanks, is such a wonderful treat (although gelatinized collagen is also important). This is where the idea that bones add flavor to meat began.

But bones contribute no significant flavor to meats cooked by dry cooking methods such as grilling, low and slow barbecue, oven roasting, or frying (frying is considered a dry method because there is no water). A tiny bit of marrow might escape the bone ends if they have been cut, and a minuscule amount may escape if the bone has been sawed open lengthwise, as it often is for T-bones and ribeyes (see

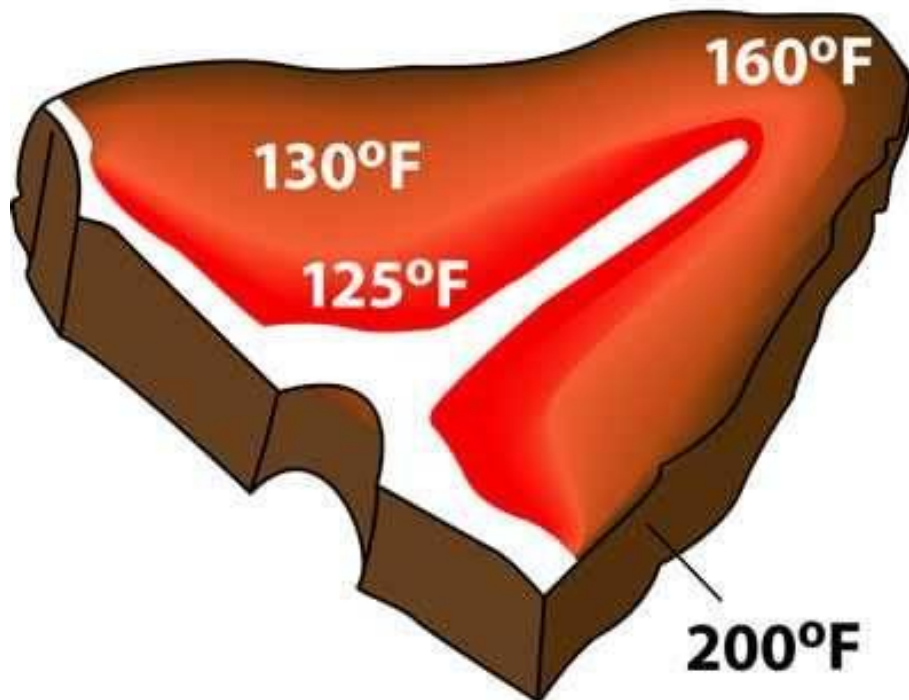
the ribeye photo above). But the small amount of liquid in red marrow does not travel far onto or into the meat. It can influence only the meat immediately adjacent to the bone.

It is possible that some of the fat and collagen inside the marrow can exit through the pores in the bones, but again, this is a very small quantity and there is no way it can travel more than a fraction of an inch into the muscle if it can somehow get beyond the sheath surrounding the bone. Some marrow may drip onto the fire, and when it incinerates the smoke and gases might strike the surface of the meat. But this is a small amount of the total drippings, most of which is edge fat, intramuscular fat (marbling), and myoglobin (mostly water from within the muscle cells).

THERMAL IMPACT OF BONES

In bone-in steaks, the bones can have an impact on heat transmission. Some bones, particularly those that have a honeycomb like interior, are slow to heat up because they are a Styrofoam-like insulator filled with air pockets. Then when they get hot, they can retain heat longer than the meat. It's sort of like a pizza stone. If you put a pizza stone in the oven, turn on the oven, and then immediately add the pizza, the stone will be cool and the bottom of the pizza undercooked. But if you let the stone heat up for at least 30 minutes, it will retain heat and crisp the bottom of the dough. And if you serve the pizza right on the hot stone it will keep it warm for almost an hour.

Inside a T-Bone



So, depending on the total cooking time, the meat closer to the bone can be slightly more or less cooked than the meat just half an inch away. In the case of a steak, which cooks relatively quickly, the insulation properties of the bone will leave the meat closest to the bone about 5 to 10°F cooler than the center of the steak. So if you take the steak off at 130°F, medium rare, it may be rare along the bone. That can make it slightly more tender and juicy closer to the bone. Or it can be undercooked and stringy.

We asked Professor Jeffrey W. Savell, Leader of the [Meat Science Section in the Department of Animal Science at Texas A&M University](#) how bones impact meat. "We do have some national data about the tenderness, juiciness, and flavor of bone-in and boneless ribeye and strip steaks, but

the differences were very small. I believe that cooking these steaks with the bone helps to form them so that they are more uniform in thickness when cooked and protects the lean from being overcooked."

Another factor needs to be mentioned. According to Steven L. Moore, Director of Innovation at [Brand Formula](#), a food science consultancy, "Bone, in many cases seals the muscle from losing meat juices as it is cooked. So when a muscle is deboned there is usually a large area now that is exposed muscle, no longer sealed to help maintain juices through cooking. Removing a chicken breast from the breast bone for instance drastically increases the surface area of the breast that will be directly exposed to the grill or heat, which will result in more evaporation from the muscle or meat juice loss (drying) in cooking. An associated phenomena is the fact that many boneless products have also been closely trimmed while being boned, therefore the boneless version of a muscle versus the bone in version of the same cut or muscle is significantly different. Boneless chicken is usually skinless chicken, boneless Boston butt is usually a more highly trimmed Boston butt."



An important factor: Removing bone exposes more muscle to seasoning and browning, and that is very tasty stuff. Who doesn't love the crust of a roast?



There is another factor to consider. You buy meat by the pound. You are paying for bone when you buy bone in steaks. Sometimes bone-in cuts of meat are cheaper because, for instance, boning chicken breasts is labor intensive, but the price is something to consider.

Finally, there is one major reason to leave the bones in steaks, ribs, chops and other cuts of meat: We love chewing on them. The surfaces are often charred, and if the sheathing has softened, it can be very satisfying. Some people even like sucking the marrow out.

So it seems Mr. Louis Prima was right when it comes to warm air cooking. "Closest to the bone, Sweeter is the meat," he sang. But the refrain could just as easily be, "A fraction away, No difference, no way."

TRIM AND TIE

“Are you gonna eat your fat?”

— SPAULDING, IN THE CLASSIC 1980 MOVIE, CADDYSHACK



Photo from <https://meatnbone.com>

Keept the fat? No aspect of food is more misunderstood than fat. All mammals have it,

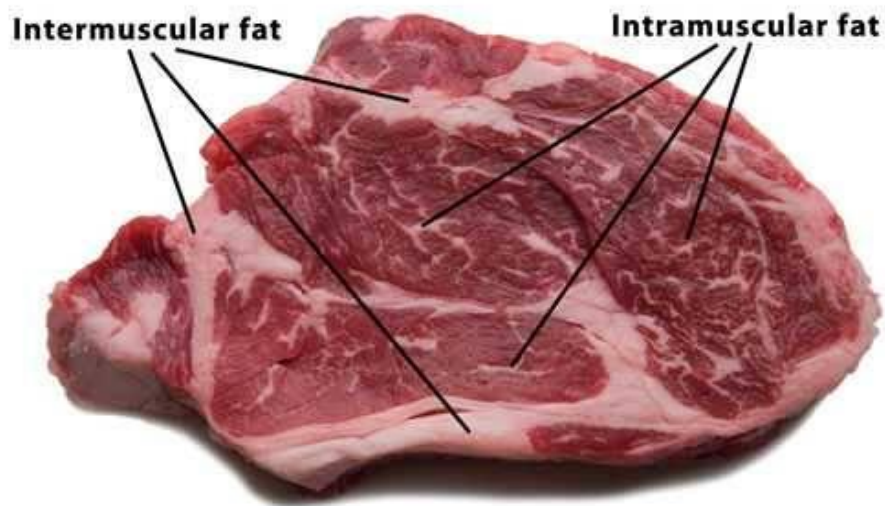
and many vegetables do too. It is essential to human life. Cut it out of your diet and you die. Eat too much and you die.

There are many different kinds of fat: Saturated, monounsaturated, polyunsaturated, trans fat, vegetable oils, fish oils, nut oils, olive oils, omega 3, 6, 9, hike. Here, we focus on solid animal fat, and what it does from a culinary standpoint, and try to settle the argument once and for all: Fat cap, on or off?

As far as the health aspects, suffice it to say: We have digested plenty of authoritative research and learned that there is a huge amount of conflicting data, so much so that one might conclude that the only ones who really know the answers with any certainty are the food fascists who want you to eat like a horse: Only hay. The scientific community is still seeking facts. We are not qualified to form a conclusion other than to say that fat makes many foods taste better and it holds lots of calories.

Fat serves many functions. Most importantly, it stores energy for the animal. It also insulates it and helps keep it warm. And because fat is a decent solvent, it dissolves and stores many of the flavor compounds in the foods the animal eats. That's why steaks from corn-fed cattle taste different than those from grass fed. If a sheep has grazed on wild rosemary, you'll taste it, and Spanish Iberico hogs fed acorns taste very different from any others. As animals age, more of these flavors build up in the fat. That's why mutton has a stronger taste than lamb.

MELTING SURFACE FAT DOES NOT PENETRATE MUSCLE



It is important to differentiate between different types of fat:

1) Subcutaneous fat, the thick hard fat layer right under the skin of many animals, also called the fat cap. Most of the fat on steaks and chops are wrapped around the edge, called edge fat, and it can cause nasty flareups. It often covers silverskin, tough connective tissue that shrinks under heat and causes steaks and chops to cup. It should be removed.

2) Intermuscular fat, the fat that lays in thick layers on top of muscles as well as between muscle groups.

3) Intramuscular fat, the thin wisps of fat that thread their way between fibers within the muscle. Also called marbling, it is the fat that gives meat its rich texture and much of its flavor.

4) Intercostal fat that is found between ribs.

THE PENETRATION MYTH

So let's say that you have a hungry crowd of rowdies to feed and this big ole honkin' pork shoulder, beef brisket, leg of lamb, or prime rib. Or a giant, 3 inch thick, 3 pound cowboy ribeye steak. The meat has a thick layer of fat on top (of the roasts) or around the edge (of the steak). The question is, leave it on or trim it off? Most books, TV cooks, and websites say that you should leave it on because it will melt and percolate into the meat making it juicier.

Nonsense.



The fat cap on a roast is usually white, fairly hard, and can be as much as two inches thick. [Meat scientist, Dr. Tony Mata](#) explains, "Fat will not migrate into the muscle as it is cooked. First of all, the molecules are too large to squeeze in. Second, fat is mostly oil. Meat is muscle and it is mostly water. Oil and water don't mix. Protein in muscle is also

immiscible in fat because of its chemical configuration. Third, in most cases there is an anatomical barrier between muscle and fat cap, namely, a layer of connective tissue holding muscle groups together. It too is water based."

The AmazingRibs.com science advisor [Prof. Greg Blonder](#) adds a fourth reason: "Raw meat is like a protein sponge. Before it is cooked it is fully saturated with water. There's no room for the fat to go in. As the meat cooks, water-based juices are being expelled from the interior. No way fat can swim upstream."

Although this is not the best example of our photography skills, you can see the point made here. Meathead dug a hole in a piece of beef and filled it with olive oil. As you can see, even after 3 hours plus, none of the oil penetrated the meat. BTW, there is an interesting additional phenomenon on display here: The meat got pinker after the myoglobin combined with oxygen. Consider this myth busted.



THE BASTING MYTH

People who defend the fat cap claim that it bastes the meat. So let's think about that for a second. What does melting fat do on the surface of protein? At high temps lipid's molecular structure can be altered and create great flavors. That's why we recommend painting a steak with beef fat during the sear phase. But at low or even medium temps, when the meat roasts, the fat just melts and drips off. It does not enhance the flavor of the meat like a paintbrush full of a flavorful basting liquid. Water based bastes cool the meat and slow the cooking which can improve tenderness. They can also to a small degree replace water that evaporates. But oil? Not so

much. There are two possible benefit: (1) Dripping fat that hits hot coals or metal below can vaporize and impart flavor on the meat. It can also cause nasty flareups. How much flavor or flareup depends on how long you cook. (2) If fat covers or coats muscle, it can inhibit water loss. But it will also inhibit browning. [Here is an article about the pros and cons of basting.](#)

FAT CAP ON OR OFF?

So if the fat does not penetrate the muscle, should you leave it on or off? Here is a summary of the pros and cons:

- When you cook meat with the fat cap on it softens, some of it browns, some melts and lightly coats exposed muscle groups, and some of it drips off into the fire where it is vaporized and can settle on the meat adding flavor. Some of the fat will drip off and can be collected for use in making gravy or stored for use in frying later.
- If you leave the fat cap on, it can slow salt penetration and salt is very effective at helping the muscle retain moisture. Salt also burrows down into the muscle and amplifies its flavor. If you leave the fat cap on a brisket, you should consider injecting brine.
- Spices do not penetrate muscle more than a fraction of an inch, but they do flavor the surface and help form the crust. If you coated your steak or roast with a wonderful spice rub, it will remain on top of the fat

and not get onto the meat. Much of that flavor and expense will drip off.

- If you leave on a thick layer of fat, most people are going to trim it off at the dinner table. If you have used a spice rub, all your expensive spices will be removed along with the wonderful browning flavors created by the [Maillard reaction and caramelization](#).
- [Most of the flavor from smoke comes from microscopic particles and gases](#), and, although the gases can penetrate, they rarely penetrate more than 1/4 inch so if there is 1/4 inch of fat it will absorb much of the smoke flavor and block the formation of a smoke ring. Click the link above to learn more about smoke, and click here to [learn more about the smoke ring](#).
- But fat does help prevent water from evaporating. Evaporative cooling is what causes [the stall](#), a frustrating phenomenon where the meat, when cooked at a low temp like 225°F, stops rising in temperature for hours because moisture evaporates and cools the surface. Hypothetically, if the entire piece of meat was covered in a thick layer of fat, no water would evaporate, there would be no stall, and there would be more water in the final product. [But water is just a part of the feeling of moisture in meat](#). Much of it comes from intramuscular fat and [melting collagen](#) from connective tissue. And the drying of the surface is part of the formation of [the tasty crust called bark](#).

- Finally, fat is full of flavor, often tastier than the meat itself, and the best tasting meats are those with small fat deposits strewn throughout the muscles, marbling.

WHEN TO LEAVE A FAT CAP ON

There are some good arguments for leaving on a fat cap.

- If your cooker has the meat sitting directly above the heat, putting the fat cap down creates a heat shield protecting the meat surface from drying heat.
- On the other hand, if you like a crunchy crust, a thin layer of fat coated with salt, spices, and herbs, can combine to create something that barbecue lovers lust for on pork butt for pulled pork, a jerky-like dried surface packed with flavor called bark.
- On the other hand, dripping fat vaporizes and transmits flavor to food above.
- On the other hand, dripping fat can flare up and if too much fat hits the flame it can produce nasty black soot.
- On the other hand, the fat layer will trap evaporating moisture and produce juicier meat, but not a hard bark. Also, after a long cook, such as the 12 hours or more a whole brisket needs, the meat dries a bit from evaporation, drip loss, and breakdown of collagen holding the muscle fibers together, leaving perhaps 5 to 10% airspace within the cut. It is a good practice to rest briskets for an hour or so in an insulated box, a

faux cambro, so that liquid can fill the gaps. Dr. Blonder says he likes to rest the meat in a vacuum bag to maximize this.

PICANHA

Now here's a cut of meat young Spaulding would love: Picanha.

In Brazil and Argentina, they relish this cut. In the US it is called coulotte or sirloin cap steak. There is a way of grilling this cut by impaling wedges on a large skewer. Mata says "A specific amount of fat cap is left attached on purpose. The skewers are placed above hot coals. When served, the wedges are sliced onto the plate directly from the skewers. The fat is consumed, not trimmed off. It is fantastic."



You may have seen or enjoyed this steak in a Brazilian themed restaurant where it is presented tableside with a flourish on a sword-sized skewer. The photo here is from the website of the Brazilian steakhouse chain, [Fogo de Chão](#). Next time you go Brazilian, taste the fatcap on the Picanha. That's one steak where edge fat makes sense.

BOTTOM LINE ON FAT

Conclusion? For big roasts with a thick fat cap, remove all but a thin layer, 1/8 inch or less. Much of that fat will melt away, but if you leave a little people can eat mostly muscle and still get a taste of flavorful fat, as well as the spices and herbs you lovingly blended and rubbed all over. For steaks (except picanha), remove the edge fat and silverskin to help avoid flareups and curl ups, and to increase browning and flavor.

WHY TIE?

Butcher's twine is often seen as some kind of decorative touch on meat, especially steaks. But its purpose is to hold the meat together, especially if the bones have been removed. Tying up a boneless ribeye can return some structure and shape to the steak. And there's an even more important purpose: To help the meat cook evenly. After trimming and boning out a cut of beef, some portions may have air gaps that expose the meat to more heat on the grill, leading to uneven cooking. Tying butchers twine around the circumference of a floppy ribeye steak creates a more

uniform shape so that all portions of the steak cook evenly. How to tie? After trimming your steak, just wrap a piece of butcher's twine around the perimeter, pull the ends tight until the meat is snug, then tie a simple knot.

ADDING FLAVOR



“If you want to sell a steak, you can't just have the sizzle, you gotta have sauce.”

— BOXING PROMOTER DON KING

*Y*our steak is ready to be cooked to perfection and now you're thinking about goosing up the flavor.

BEFORE COOKING

KISS. Many purists like it simple, just salt and pepper before you cook. Get the salt on a few hours before cooking to let it penetrate. It doesn't matter when you add the pepper. If you've got a super-expensive piece of Wagyu, then yes, that is really all you need. Let the muscle and fat sing. Some folks salt before cooking and serve a large grain finishing salt on the table. Use coarse ground pepper because fine ground can burn if you have a really hot grill.

Rub. Want to amp it up to 11? Some prime steakhouses sprinkle a secret mix of herbs and spices on their steaks, the most famous being Lawry's Seasoned Salt. Try a steak rub like [Meathead's Amazing Smoked Red Meat Seasoning & Dry Brine](#) or make your own [Big Bad Beef Rub](#) or [Mrs. O'Leary's Cow Crust](#). Scatter it on when the meat liberally before you cook. And again after it is cooked.

Butter it up. For less rich steaks, after it is cooked, a little butter does wonders. Just plop a pat of butter on the hot meat or melt some butter and paint it on. For even more

flavor, use a [compound butter](#) with some chopped herbs or spices mixed in.

Beef love. [Chef Rick Gresh](#), when he was at David Burke's Primehouse in Chicago, kept a cup next to his grill with what he calls "beef love," melted beef fat trimmed from his aged steaks. Gresh painted the steaks with it before they went into the dining room. I have taken his method one step farther. I paint the meat with beef love before it goes on the direct heat as well as before I serve. It enhances browning and brings great flavor to the party.

To make your own beef love, just ask your butcher for a pound of suet, the term they use for beef fat. Butchers trim pounds of it every day and throw it away. It won't cost you anything. Take it home, chop it into cubes about 1/2" and put them in a pot over medium heat to medium low. Put on the lid. After a few minutes you should see tallow (liquid suet) in the pot. If not, raise the heat slightly. After about 30 minutes most of the fat will have melted. There will be some fibrous matter that doesn't melt, just throw it away. Pour the tallow into a heavy bottle, let it cool and solidify, and store it in the freezer. It will keep for months.

When it is time to cook your steaks, scoop off an ounce or two and melt it on the grill. As an alternative, I have had great luck using rendered bacon fat, duck fat, and goose fat as beef love.

Marinades. Prime steakhouse rarely marinate steak. Marinades mask the meat's natural flavors and a wet surface creates steam while cooking and prevents crust formation.

AFTER COOKING

If you have a great well marbled steak, the best thing you can do is get out of its way. Keep it simple. But with leaner cuts like skirt, flank, or sirloin, caramelized onions, grilled onions, mushrooms, grilled red peppers, or a sauce can give it life.



Board sauce. Chop up some herbs, crush some spices, mince some garlic and chiles, and mix them with olive oil, melted butter, or melted beef fat, and dump them on the cutting board. When the meat comes off the grill just plop it on top and slice away. The meat juices mix with the flavored oil and shockingly, one does not overwhelm the other.



Chimichurri. Argentinian chimichurri is a bold green paste of herbs, usually parsley and cilantro. That brings bright flavors to the plate.

Red wine sauce. We love big red wines with beef, so it is natural to make a classic French red wine sauce.

Horseradish cream sauce. The classic sauce for steak and roast beef sandwiches. Just ask Arbys.

Hollandaise or Béarnaise sauces. Another classic French treatment for beef are these two sister sauces. The base is similar for both sauces, emulsions of egg yolks with vinegar and/or lemon juice. Béarnaise get amped up with shallots and tarragon.

WHEN TO COOK HOT AND FAST AND WHEN TO REVERSE SEAR

“Speed kills, but beauty lives forever. Speed thrills, but beauty knows your name.”

— *SMASHING PUMPKINS*

The Platonic ideal of a perfect steak is a slab of meat that is an even dark flavorful Maillarded mahogany brown on all surfaces, and a rosy 130 to 135°F red edge to edge in the center with just the right salinity in every bite.

To accomplish this, it is important to understand that heat from outside the food cooks the exterior, but it is the exterior of the food itself that cooks the interior. The hot air molecules inside the cooker transfer energy to the molecules in the exterior of the food and they pass their excitement along to the interior, like a bucket brigade of heat. So we must look at the exterior and interior as two separate projects. We must cook the exterior and the interior differently.

The cooking technique depends on how thick the steak is.

WHEN TO COOK HOT AND FAST



Rule of thumb: The thinner the meat, the higher the heat. The thicker the meat, the lower the cooking temperature.



Hot and fast works for thin, skinny foods like skirt steaks (shown after slicing below), asparagus, and shrimp because skinny foods cook quickly. If you want a good dark brown sear (and you do) you need high heat to make that sear without overcooking the interior.



To cook hot and fast, you need to get the food directly above the heat source so infrared radiant heat can go to work on it. We call this cooking at Warp 10. This is when you crank your grill to “Give 'er all she's got, Scottie.” In the Star Trek series, this was about as fast as any starship could go. You won't find the expression used in a culinary context anywhere but here, so don't ask a chef for steaks cooked at Warp 10. She won't know what you want. Then again, she might...

When cooking steaks at Warp 10 you usually want the lid up so heat is being applied only to the bottom surface, and you want to turn the steak often, like a human rotisserie, so the hot side cools quickly, which keeps the intense direct radiant heat focused on the surface without allow weak reflective heat to cook the top and thus overcook the center.

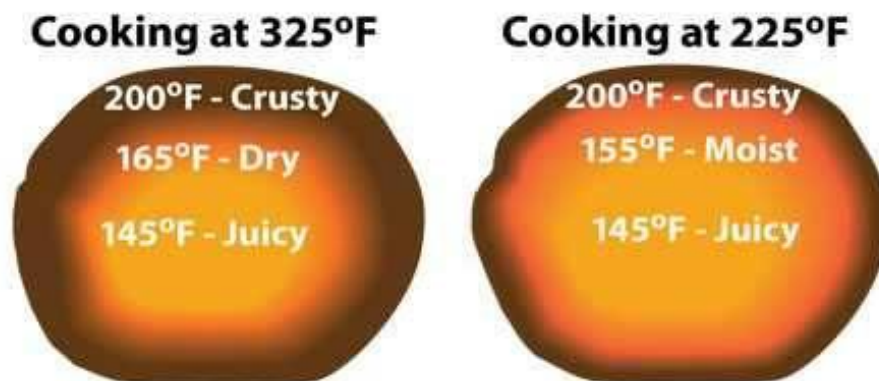
Here's a trick for skirt steak and other really skinny pieces of meat: Put it in the freezer for about 30 minutes to get it cold. The extreme high heat of an infrared burner on a gas grill, or on a charcoal grill with the charcoal lifted close to the cooking surface, will thaw the steak's exterior rapidly and brown it. But the heat takes time moving inward and the cold center will heat more slowly and won't overcook. Just make sure you don't freeze the meat solid because the ice crystals can puncture cell walls and liquid will escape making the surface wet and impede browning. You just want to steak in the freeze longer enough to get really cold.

WHEN TO USE LOW AND SLOW

Hot and fast will carbonize (burn) thicker steaks and turn tough cuts of meat into jawbreakers before the center is proper temp.

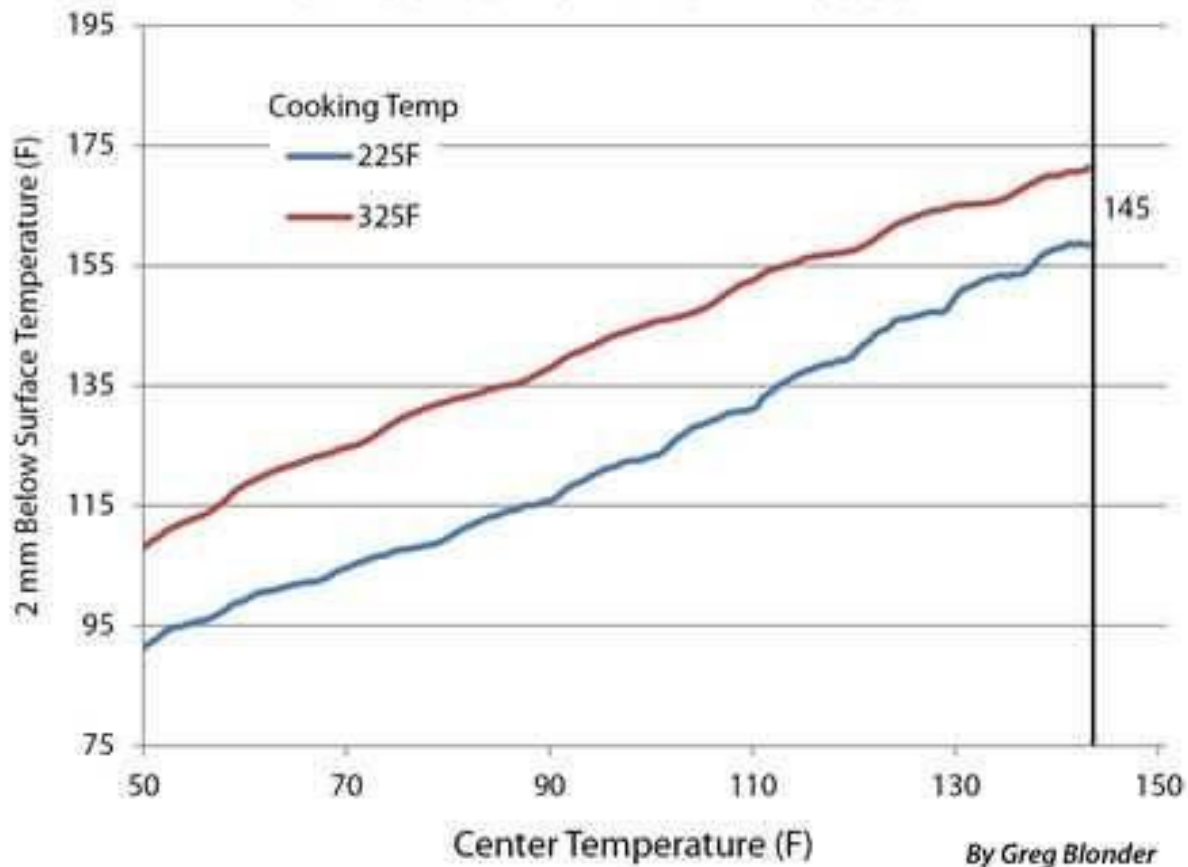
Remember, water is a good insulator so heat slogs slowly through the watery interior of foods, especially meats, which can be up to 75% water. Large foods more than 1 inch thick, like thick steaks, beef brisket, prime rib, turkey breast, and baked potatoes need a lot of time to get warm in the center. Turning up the heat loads up the outer layers with heat

before it can be transmitted to the center and as a result you get a rainbow of temperatures. On the outside edges, the meat may be more than 200°F, just below the surface 180°F, just below that 170°F, and so on.



Look at this table and drawing based on an experiment by the AmazingRibs.com science advisor [Prof. Greg Blonder](#). He took two pork loin roasts about 4 inches wide and 3 inches tall and roasted one at 325°F and the other at 225°F. By the time the center of the meat hit the desired temp of 145°F, the outer layer of the one cooked at the higher temp was a parched 170°F while the one cooked at the lower temp was a still moist about 160°F. That means that the one cooked at the higher temp had a lot more overcooked dry meat in the outer layers of the meat. Now imagine what would happen to a thick prime rib?

Surface To Center Temperature Difference In 3 Pound Pork Loin Roast

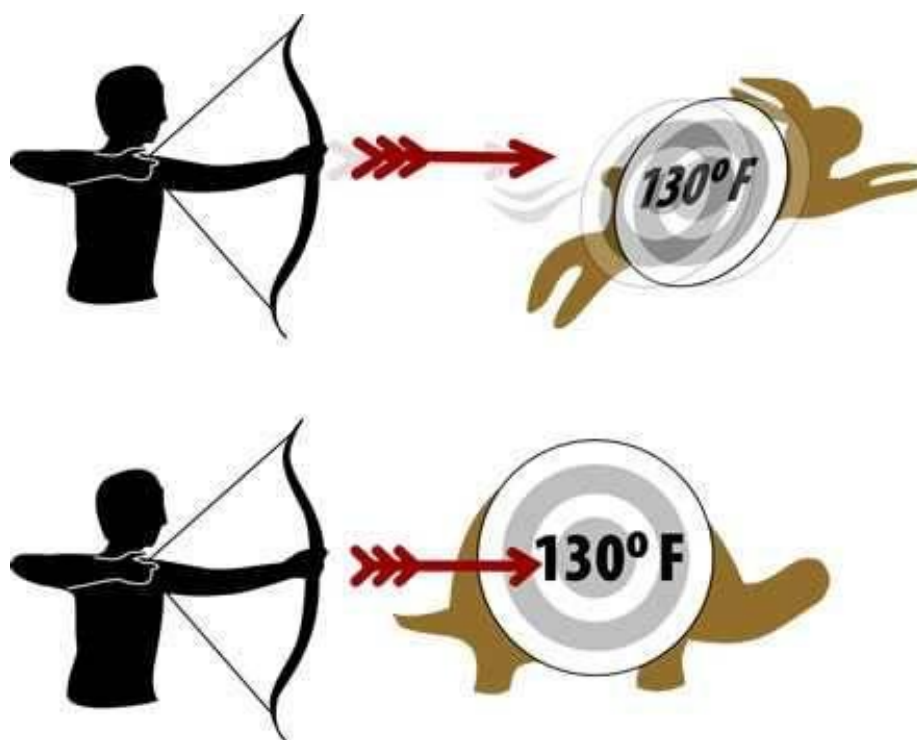


But if you lower the temp and lower the lid, the heat has time to move to the center of something like a thick ribeye steak, less heat builds up on the exterior, and more of the meat is cooked to the target temp.

Low and slow is also essential for tough cuts like beef brisket, pork shoulder, and ribs. These cuts are too tough to eat at medium rare, 130 to 135°F, the optimum temp for most other cuts of beef and pork. These tough cuts have lots of tough connective tissue. But if they are cooked long enough to a mind boggling 203°F or so, magic happens. Fats melt

and the tough stuff softens up like Marshall Dillon in Miss Kitty's arms (and with that reference, now you know how old Meathead is).

There is another very good reason to cook low and slow. It is easier to hit the bullseye of a slow moving target. You stand a better chance of getting the food done to the proper temp without overshooting the mark. You widen the window on perfection. Thick steaks can go from succulent to sucky in a hurry at high heat.



Also, when you cook low and slow, you give salt time to migrate towards the center, seasoning the meat throughout. That's because if you salt or brine meat, even if it sits in a brine overnight, the salt takes its time moving towards the center and stays mostly at or near the surface. But when

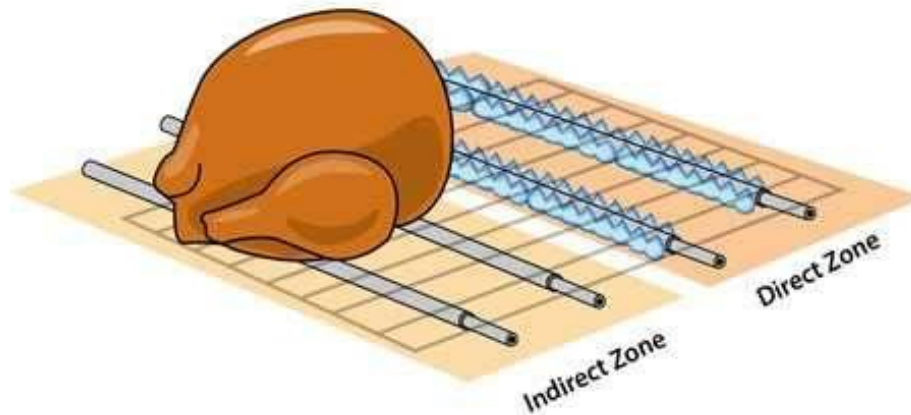
meat heats up, the salt moves faster [as demonstrated in this original research](#) for AmazingRibs.com by Dr. Blonder.

You also give the food more time to bathe in smoke. On a steak, for example, if you sear it first and cook it quick, you don't get much chance for smoke to flavor the meat. Starting low and slow gives you more smoke flavor.

SO HOW DO YOU COOK LOW AND SLOW?

You cook low and slow with warm convection air instead of cooking directly over radiant heat. To do this, you need to master the single most important technique for the backyard cook: The [2-zone setup](#).

2-Zone Setup On A Gas Grill



A quick review of the 2-zone setup: You need a hot radiant "direct zone" where you can put the food directly above the heat, and a warm convection "indirect zone" off to the side where the warm air circulates around the food in a convection flow. The illustration above is for a gas grill. On a

charcoal grill you push the coals to one side. Your exact setup will differ if you have a different type of grill. For details, our article on [the 2-zone setup](#) has links to several pages devoted to different setups for different cookers.

You need to experiment with your grill so you can stabilize the indirect zone at about 225°F and 325°F with the lid down. These are two special numbers and almost all our recipes are pegged at one or the other, with occasional calls for [Warp 10](#) in the direct zone for searing.

At 225°F you can slowly and gently raise the interior temp of thick steaks, maintaining their moisture.

THE CHALLENGE: COOKING THE INTERIOR AND EXTERIOR SEPARATELY

The problem with low and slow is, if you are cooking something like a thick steak, which you remove at a relatively low interior temp (135°F for medium rare), you don't get a dark crust.

The solution is to combine both methods, low and slow plus hot and fast. Consider this special occasion meal: A 26 ounce, 2 inch thick, bone in, prime grade, ribeye steak to be shared with someone special. These babies can cost about \$60 *each*. You don't want to screw it up.

The challenge is to get the outside dark and crispy, yet not overcook the interior. We know that meats are best when crispy and GBD (Golden Brown and Delicious) on the outside,

and tender and juicy on the inside, yet warm enough to kill all microbes.

Searing is a method of developing spectacular flavor and texture when the Maillard reaction starts to alter amino acids on the surface and caramelization of sugars joins the party. But searing, it has been proven, does NOT seal in juices, contrary to popular opinion.



The perfect steak

To steakhouses, the perfect sear is a uniform whiskey brown surface with perhaps a little black charring of the fat on the edges. When that occurs, you have so changed the composition of the muscle and fat, that you have reached steak Valhalla. Their secret is getting the steak, especially the fat as dark as possible without burning it.

But if you take a 2 inch steak and just plop it down over high heat, you can get that dark mahogany crust, but just below it is a band of meat that is brown, then a band that is tan, then a band that is pink, and finally, a band in the center that is

medium rare, reddish pink, the temperature at which steak is juiciest and most tender.



To cook both the interior and the exterior perfectly, you need to cook them differently: You need to master two stage cooking a.k.a. the reverse sear.



Here's the idea: It's hard to catch a moving bus. In a hot grill or oven, if you want to cook your steak to medium rare, let's say 130 to 135°F, you have a small window of time at which the meat is the perfect temp. As a cook, you have to jump on a moving bus because the temp is steadily rising inside the steak. Then you have to worry about carryover cooking, because the thermal mass, the energy trapped inside the meat, continues to cook the meat even after you take it out of the heat, and the temp can rise another 5°F on thick cuts, creeping up to overcooked.

A method called sous vide stops the bus (and we have a whole ebook on the subject of Sous Vide Que, combining sous vide with the grill or smoker). To cook a steak sous vide, you place the steak in a plastic bag and press out the air. Then you slip it into a water bath with a precision digital controller set for precisely 131°F. The meat slowly rises to 131°F and stops. It cannot get any warmer. You can leave the meat in there for hours if you wish. At 131°F in the center, enough bacteria are killed in about two hours that it is

pasteurized. Even a hamburger. Yes, you can cook a burger to medium rare and be perfectly safe. There is another benefit.

Remove the bag, cut it open, and the interior of the meat is the perfect color all the way from one edge to the other. There is only one glaring problem: It looks repulsive on the outside. The exterior is pale gray and totally unappetizing. So sous vide cooks usually take the meat out of the bag and throw it in a scorching hot pan or on a grill for a few minutes per side, and you get all that magnificent Maillard color and flavor. It is now a two step process: One for the interior, one for the exterior. So when you cook sous vide, you no longer have to run to catch the moving bus. It just sits there at the bus stop waiting for you at whatever temp you pick.

Unfortunately, sous vide machines cost about \$100, the food takes hours to cook, and frankly, not all foods benefit from the process.

So what's this got to do with grilling a steak? Well, you can cook a steak sous vide and throw the meat on a grill, even a cheap hibachi, and get a pretty good sear. A lot better than just tossing it on a scorching hot pan. And the steak is awesome! Works for chicken, turkey, pork chops, you name it. We call it Sous-Vide-Que.

REVERSE SEAR, A.K.A. "REDNECK SOUS VIDE," TO THE RESCUE

Or, if you don't have a sous vide machine, here's the solution: *Redneck sous vide*, as our grilling buddy John Dawson calls it. He is riffing on the sous vide technique that

so many great chefs use. Other folks call it reverse sear or sear in the rear, and it is pretty simple.

If you have experience cooking indoors, you know a lot of recipes call for you to brown meat in a pan before finishing in the oven or in a pot. Two steps. Two temps. Sear over high heat, finish at low heat. This is the recipe for pot roast (brown in a hot pan, braise slowly in a covered pot), even for pan roasted chicken (brown in a hot pan, slow roast in the oven). So it is deeply embedded in chefs and cookbooks that the order of things is brown, then finish.

But that approach is backwards as demonstrated by the sous vide cooks! When you start with high heat, you load up the exterior, and by the time you are done you have a thick band of overcooked meat. If you reverse the order, start the food in the indirect zone at a lower temp, warm everything until it is close to uniform on the inside, and then hit it with Warp 10, you get both a better interior and exterior. That's reverse sear, and it's a technique you should master. It is the best approach for many foods.

Start by setting up your grill for 2-zone cooking. Try to get the indirect zone down to as close to 225°F as you can with the lid on. Put your steaks (or a roast or chicken) on the indirect side, toss a little hardwood on the flames, close the lid so the meat will roast slowly with smoky convection air. The bus is not stopped, but it is moving slowly. Roast the meat slowly until the center temp is about 10 to 15°F below your target temp. You absolutely positively need a good instant read digital thermometer like the Thermapen for this. Flip it once or twice while it is slow roasting. You may

have to experiment with technique to keep the temp down. Here's how we do it on a Weber Kettle. The meat is under the pan.



So when your steak hits 115°F in the center, take it off and put it on a plate for a moment. You are done working on the center. Now go to work on the exterior.

Take the lid off, and crank up the heat on the other side as hot as you can get it. If you have a charcoal grill where you can adjust the height of the coal bed, get the coals right below the cooking surface. If you want, dump more pre-lit coals on the direct side of the grill. Or set up a hibachi with a thick bed of hot coals. If you have a gas grill, turn the burners to high or turn on your sear burner. Whatever you do, get to Warp 10.

Put the meat on the hot side and leave the lid off. Just like hot and fast cooking, we want all the heat focused on one surface at a time. We don't want any heat reflecting off the

lid down onto the top of the steak further cooking the interior. You want to cook the surface until the moisture steams off and it turns deep and dark bourbon brown, but not black. You do not want carbonized protein or fat, but take it right to the edge because it is at that edge when dazzling things happen.

Flip often and move the steak around a bit so the grates, which are going to be searing hot, don't make black grill marks. Flipping often allows the surface that is being superheated by direct infrared radiation to get away from the heat and cool off by allowing energy to escape into the air. It is the same idea as rolling over on the beach for a more even tan. Grill marks may look pretty, but we want the entire surface of the steak as dark as the grill marks.

If you started with high quality meat, when you are done browning the surface with the reverse sear method, you will have finally produced a restaurant quality steak at home. Reverse sear is the best way to get edge to edge medium rare on a thick steak without that thick band of battleship gray meat under the crust.

Here's a video of Meathead demonstrating both methods.

In the video, you can see a sirloin, 1 1/4 inches thick when raw, cut into two steaks. The top half was cooked entirely over hot coals, where the air temp was about 600°F. The bottom steak was reverse seared. Both steaks were turned every three minutes. The top steak reached 130°F in 13 minutes. It achieved a very dark but not quite burned crust, and, as you can see, much of the meat was overcooked (tan).

The bottom steak also had a dark crust, just a shade lighter, but as you can see, the overcooked portion is much smaller.



The flavor of the two steaks was practically identical, but there were two very big differences: The reverse sear steak was noticeably more tender and juicy. If you want to start cooking these steaks now, [click here to jump to the recipe for Big Thick Steakhouse Steaks](#).

If you have a sous vide cooker, that makes reverse searing a thick steak a cinch: sous vide the steak to a temp that's just under your ideal doneness (let's say about 110°F), then blast

it with raging heat on a grill. Of course, you could get your raging high heat from a cast-iron pan instead of a grill. You'll get a nice browned crust. But you won't get the awesome smell of wood smoke from the grill.

GRILL MARKS



All the instagram hero shots, all the grocery store advertisements, the restaurant ads, the grill ads and most meat ads show beautiful steaks and burgers with cross hatched grill marks. Restaurants can even buy chicken premarked with grill marks that they can microwave and serve. Cooking magazines and cookbooks teach readers how to get great grill marks like the ribeye above.

Overrated.



Look at the ribeye above and the one on the cover of this book, and then look again at the striped steak, a winner at a Steak Cookoff Association competition where grillmarks always seem to win.

Doesn't the grillmarked ribeye elicit a Pavlovian response? Yes, we're trained to salivate at the sight of grill marks. But I'm here to tell you, the ribeye without the grill marks will taste better.

What gives?

When it comes to meats, and many other foods, the goal is golden to brown color on as much surface as possible. Dark brown crusts on grilled meat are the most flavorful part because dark brown is the result of changes in the chemistry of the meat. Called the *Maillard reaction*, browning occurs when heat changes the structure of amino acids, proteins, and sugars, creating hundreds of new really tasty compounds. We call that searing, and the result is a crust that to many of us is the highlight of the meal. When it comes to most foods, brown is beautiful. Black is not. Tan is not.

Chefs know this.

Those beautiful grill marks are merely superficial branding, just coloring on the surface — like the freckles on Lindsay Lohan, cute, but lacking substance — unlike the deep rich sear that delivers max taste and texture in the ribeye at the top of the page.

The steak with the mouthwatering cross hatches has perhaps 1/3 of the surface fully browned, but the diamond shapes between the grill marks remain tan, boring, well done meat, whose potential is unrealized, like Superman without a phone booth, like Gehrig without a bat, like Chopin without black keys.

Worse, if you're not careful, grill grates can scar your meat with black stripes of chalky carbon that tastes like burnt toast.

That's one of the reasons that many great steakhouses use broilers where the flames are *above* the meat. That way they can get brown all over. That's why grill marks don't make me salivate. I want brown all over.

Here's what's going on.

Not all heat is the same. As I describe in [my article on the thermodynamics of barbecue](#), cooking on a grill involves radiation, convection, and conduction. Conduction is when the metal grates are in direct contact with the food. It is the fastest way to transmit heat to meat. Radiation is the heat carried by infrared light emanating from coals or gas burners directly below the food. It is second fastest method. Convection is the warm swirling air if the meat is not directly exposed to flame. It is the slowest method. Conduction cooks faster than radiation or convection.

Metal grill grates transmit heat much better than air because they have so much more mass. Air is really a better insulator than conductor. That's why styrofoam is filled with air.

Here is a picture of the steaks from some of the finest, most expensive steakhouses in the country. They are (1) Stock Hill in Kansas City (2) Chandler's in Boise (3) Gibson's in Chicago (4) Knife in Dallas (5) Hall's Chophouse in Charleston (6) Peter Luger in NYC (7) Ruths Chris nationwide (8) Porterhouse in NYC (9) Smith & Wollensky in many cities.





HOW TO GET THE PERFECT MAILLARD SEAR

So how do you get the perfect all over Maillard brown sear? Cook the meat in a cast iron pan with a thin coat of oil. Or use a [griddle](#).

Or flip flip flip. But all the books say to flip your meat as little as possible! Don't believe them!

Among the advocates of frequent flipping are Harold McGee, author of *On Food and Cooking: The Science and Lore of the Kitchen*, J. Kenji Lopez-Alt of [SeriousEats.com](#), Nathan Myhrvold, editor of the landmark six-book set *Modernist Cuisine: The Art and Science of Cooking*, and the [AmazingRibs.com](#) science advisor [Prof. Greg Blonder](#), all culinary scientists of serious consequence.

Lopez-Alt decided to test the theory. He made a dozen 1/2 pound burgers and cooked them in a steel skillet heated to 450°F. He flipped some often, every 15 seconds in some cases, and others he flipped only once. He took them all to an internal temperature of 125°F (medium rare and well under the USDA recommended safe temp) and then rested them for five minutes at room temp. Sure enough, the patties that were flipped more often cooked in 2/3 the time, the edges were more brown, and the color was more even top to bottom. The single-flip burgers got a little darker on the outside, but had a thicker layer of well done and overcooked meat under the surface, up to 50% of the thickness! That number fell to 40% when flipped every minute, 35% when flipped every 30 seconds, and 30% when flipped every 15 seconds.

Here's what is happening. When the meat is exposed to contact with the hot pan it absorbs heat a lot faster than when exposed to hot air, which is not a good conductor. The molecules on the meat's hot surface get excited and start moving around a lot raising the temp of the slower molecules closer to the center. Then, when you flip the meat, the surface cools a bit immediately so it is less likely to burn when you flip it towards the heat, but the molecules below the surface, are still jumping around and inviting their buddies to dance along with them. The same thing happens when the meat is over infrared. The process is essentially the same as when you are cooking with a rotisserie. Blonder points out that "Many famous steak houses cook steaks in two-sided broilers that subject meat to direct flames from above and below - truly the gates of hellicious browning."

I asked the AmazingRibs.com science advisor, Prof. Greg Blonder, what he thought of the concept. "Flipping every 15 seconds is just barely OK. If you flip that fast, the crust does not form because each time you flip you have to steam off any exuded water before browning can start. This takes more than 15 seconds. I think the better approach is to keep the meat flat for at least a minute, then flip. Of course, on a grill the steam quickly exits between the grates, so you can flip faster than in a frying pan."

DAVID PARRISH'S COLD GRATE TECHNIQUE

David Parrish is the inventor of the [Slow 'N Sear](#), a must have for owners of the Weber Kettle. He's a fan of this site and the reverse sear, and one day he had an ah-ha moment.

When searing steaks the hot grates make grill marks and even if you flip often, they can burn. He realized that during the sear step in a 2-zone setup some of the grates were hot, some were cold, so he began rotating the grate so the steak when on cold metal.

CAVEATS

Now keep in mind, a lot depends on the type of meat, its thickness, and the heat of your grill, but if you understand these concepts, you can amp up your grilling: Shoot for a uniform all over deep golden to mahogany color, just this side of black, and to get there use either thin wire grates with the meat right above the heat, or a flat surface like a griddle or the back of [GrillGrates](#), and turn often.

SEAR IN A PAN OR ON A GRIDDLE



*M*any cooks sear in a screaming hot cast iron pan with a thin layer of high smoke point oil for as little as a minute per side. Because this can create a bit of smoke and set off smoke alarms, it is a good idea to do it on a grill, especially if it has a good side burner. Get the oil so hot that it shimmers and just begins to smoke before you put the meat in. Press it down gently so it makes contact with the pan. Boneless cuts sear better than bone-in because the bone can prevent the muscle from contacting the pan.

SEAR WITH A TORCH



Some folks even get out a torch for searing. It works, but getting an even sear is tricky because the energy intensity depends on how close you are to the meat and even then, you don't get the deep dark sear of a hot pan or a grill. Pictured below is a Searzall attached to a disposable propane tank with a trigger ignition and a regulator such as the Bernzomatic TS8000. A simple butane kitchen torch works OK, too. Some people say they can taste propane or butane

gas, but the Searzall combusts very efficiently, and we have never noticed it.

SEAR ON A GRILL

*F*irst, no matter what searing method you use, you need to pat the wet meat's surface dry with paper towels so the surface doesn't steam when you blast it.

When searing on a grill, you need to expose the meat to direct infrared radiation. Hot air just doesn't do the job. It just doesn't matter how hot the thermometer on your Giant Green Avocado reads. It is measuring *air temperature* and that is not the same as measuring *energy*.

If you are not clear on the difference, do this experiment: Preheat your oven to 200°F and insert your arm.

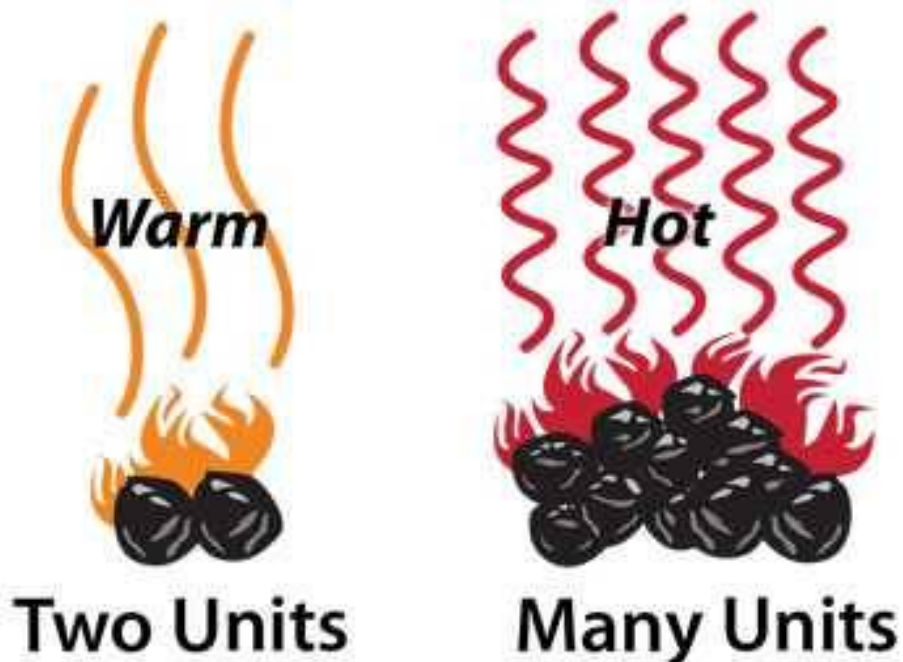
Surprisingly, you can hold it there for a while. Now place your hand on the side wall of the oven, which is also 200°F. When you get back from the hospital you will understand that the energy stored and transmitted by metal is much greater than that stored and transmitted by air even though they are both 200°F. That's why a metal pan or griddle or grill grates sear so well.

To sear on a grill, you need to expose the meat's surface to infrared radiation (IR) in the form of red glowing coals or

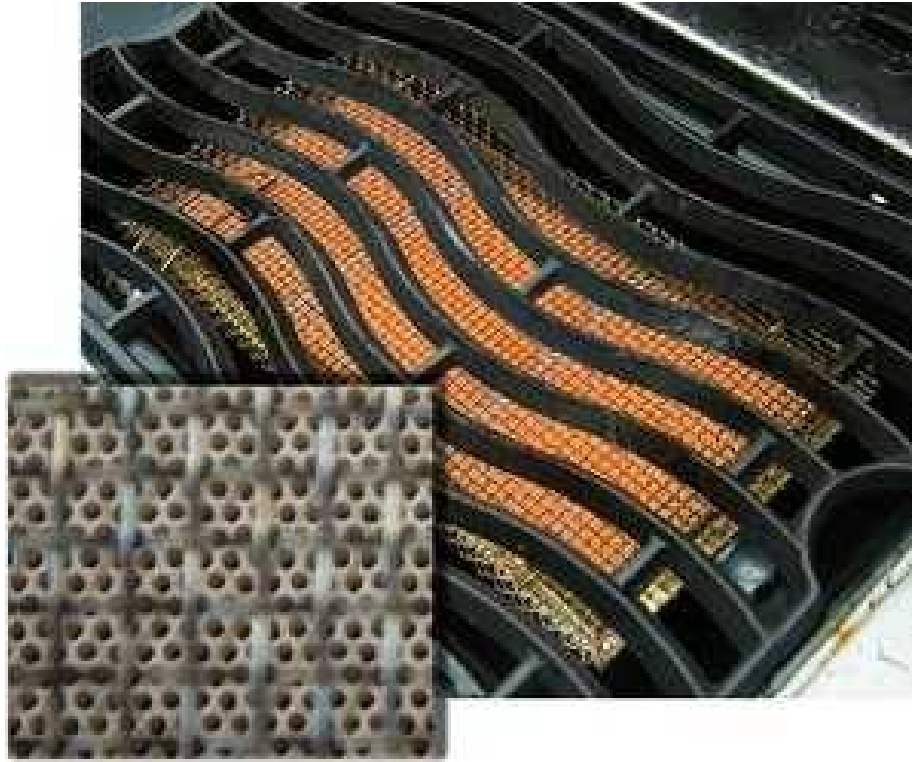
flame. While not as energetic as hot metal, IR transmits a lot more energy than hot air and heats food almost immediately. That's why you can get a better sear from a \$30 charcoal hibachi than a \$1,000 pellet "grill" which heats mostly by indirect convection air energy like an indoor oven.

We love what a charcoal grill does for sous vide. It makes top notch sous vide que. Charcoal grills generate more IR than gas grills, and the heat gets more intense as the layers of charcoal get thicker. Charcoal, especially if it is stacked 2 to 4 briquets deep, produces massive amounts of IR. Take the meat out of the sous vide bag and let it cool a bit so you don't overcook the center, pat it dry, sprinkle on a some coarse ground black pepper (remember, we salted it before it went in the bag), and then toss it over flame.

More Charcoal = More Heat



Some gas grills have “sear burners,” but few can generate the concentration of energy that charcoal produces. One exception is this sort of “infrared” burner, a ceramic honeycomb that converts gas flames into infrared radiation.



Proximity is also an important factor. The closer you are to the IR the more intense the energy is. So, in order to get a great sear, place the food directly over and as close as possible to glowing coals or flames.



Always leave the lid open so the IR is focused on one side and flip often. With the lid closed, warm air will attack the top and it can overcook the food. By leaving the lid off and flipping the food often, you allow much of the energy built up in the surface layer facing the IR to bleed off into the air when you flip, rather than push its way to the center of the food. In a few minutes, you have an extraordinarily tender steak, with a nice crisp complex sear, and a little smoky flavor.



Here is one of our favorite methods. Fill a charcoal chimney halfway to 2/3 with briquets, not lump. Because some lumps are large you don't get as much infrared as with briquets, and because briquets are uniform in size, the energy is consistent from chimney to chimney. When they are fully ignited and coated with white ash, after about 20 minutes, a column of flame roars from the top. That's some serious IR. We call it the afterburner because it looks like the backend of an F-16. Place a grid on top of the chimney and sear the heck outta that steak. For this method you need long handled tongs and you must to flip the meat every minute to avoid incineration. Watch your eyebrows and beard.

SMOKING

The question is, how much smoke do you like? It's like black pepper. Say when! It is not hard to over smoke meat. You can smoke on a smoker or a grill, and there are a few tricks that ease the way.

Preheat with a 2-zone setup and get the indirect convection side to 225°F. Throw wood chunks on the flame or coals and when there's a good cloud of smoke rolling, put the meat on the indirect convection side. Use a mild wood like oak or apple. When the smoke stops, resist the temptation to add more. Taste the finished meat first. If you think it is not smoky enough, next time add more wood when the first pieces die out. Don't just add more at the start.

CARRYOVER COOKING

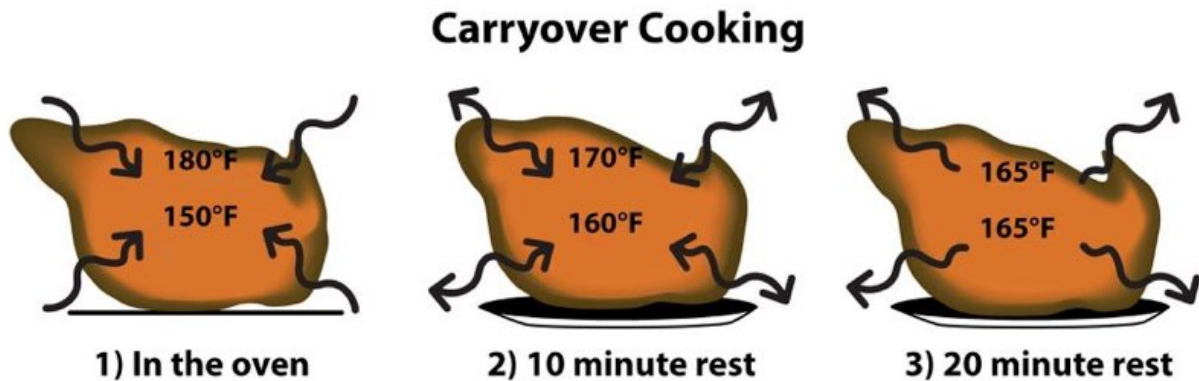
Carryover is simple physics. Here's how it works: In a 225°F indirect zone, the surface of the meat will slowly warm. This warming is the process of exciting the molecules so they move faster. It takes time because the meat is a combination of water, fat, and protein, and they are good insulators.

As the surface warms it conducts its heat slowly inward to the cooler cells beneath, passing it along like a bucket brigade. Excited molecules get their neighbors excited by bouncing off them like billiard balls. Slowly the heat marches towards the center.

As the exterior passes the heat along, it loses heat, so the bucket brigade prevents the surface from zooming up to 225°F. Also, moisture on the surface evaporates, cooling the surface in the same way sweat cools you off on a hot day. Not to mention that, because meat is mostly water, it can't get much above 212°F. If the meat is thin, the heat builds up rapidly. If it is thick, it takes much longer to get to the desired temp in the center. The trick is to get the center to

the target/safe temp without overcooking the exterior. One technique is to baste the exterior, but that keeps the skin wet and soft, and we want our skin dry and crisp.

Interestingly, the meat keeps cooking after you take it out of the heat. The hot outer parts continue to pass their heat inward and in 15 to 30 minutes after coming out of the oven, the center of the muscle can rise another 5 to 10°F. Some heat also escapes into the air, so we don't want to leave the meat sitting around too long or it gets cold.



In the illustration above, on the left we have a piece of meat cooking at 325°F. It is absorbing heat from all sides, the outer surfaces are hottest, and the heat is passed to the center by conduction. In the center picture, the meat has been removed from the oven. Heat continues to be passed towards the center, even though it is sitting at room temp, and some of the heat is escaping into the surrounding air. On the right, the meat has come close to an even temp throughout and now it is cooling as more heat escapes.

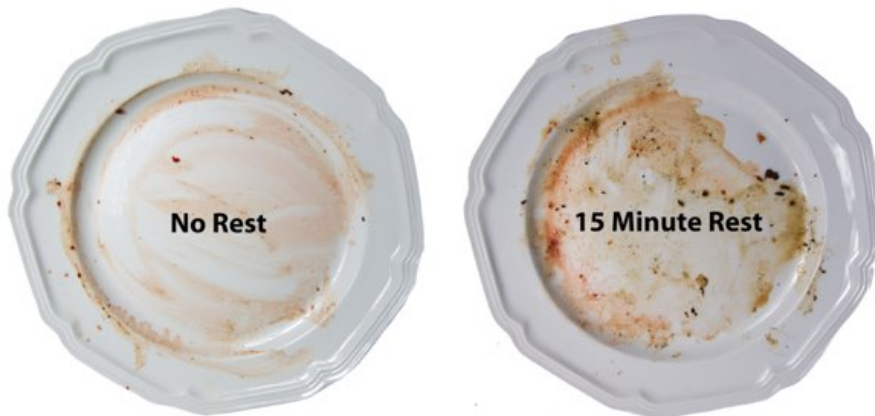
To be absolutely safe and still have moist and tender whole birds, you should *serve* turkey at a minimum of 160°F

measured in the deepest part of the meat and test it in multiple locations with a good digital thermometer.

NO NEED TO REST YOUR MEAT

"Every time someone calls it blood, a bell rings and somewhere a teenager somewhere becomes a vegan."

— *MEATHEAD*



When it comes to steaks, interior doneness is a matter of personal preference. But most sensory scientists and chefs agree that medium-rare, 130-135°F is the sweet spot. Steakhouse chefs know that if they had to cook it to 145°F, medium-well, as the USDA recommends, they would go out of business in a hurry. They also know

that they would go out of business even faster if a customer died from eating one of their steaks. The good news is that the risk of bacteria surviving on the interior of solid beef muscle at 130–135°F is extremely low.

Likewise, it is widely preached that we must let meat "rest" after it is cooked for fear that we might drown in all the escaping fluids when we cut it. Let's define some terms. **Resting** meats cooked to 165°F or below, we are told, makes meat more juicy. Steaks and chops are said to need 15 minutes, thicker roasts and turkey breasts are said to need up to 30 minutes. **Holding** some meats cooked up to 200°F or so is very different from **resting** meats cooked to less than 165°F. Let's start by focusing on resting meat cooked to 165°F or below. Is it necessary? Hint: Much of the answer lies in the photo of the plates above. To get the whole answer, we need to look at:

1. What causes juiciness
2. What happens to meat when it leaves the heat
3. How we eat in the real world
4. Some of the experiments people have done to test the theory

SOME FACTS ABOUT MEAT

Think of meat as a protein sponge. Raw muscle is about 70% liquid. This liquid is not blood, which is dark red, almost black, thick, and it clots. There is no measurable blood in a

properly slaughtered and butchered animal. Most of the liquids in muscle are *myowater*, water laden with the protein called *myoglobin*.

Myowater is thin and usually pink, and it doesn't coagulate like blood. It is what you see on your plate when you cut into a piece of meat fresh from the heat. Remember, Zuzu, everytime someone calls it "blood", a bell rings and somewhere a teenager becomes a vegan.

What we call juiciness is not just a matter of how much water is in the meat we are eating. There are many factors.

SOME FACTS ABOUT JUICINESS

Food scientists tell us that when we taste meat, the most important measures of quality that we look for are

1. Tenderness,
2. Flavor, and then
3. Juiciness.

What we perceive as juiciness is complicated. In the 2011 journal *Meat Science*, Pearce, et al, surveyed the literature to present a summary of what is known of water in meat and they say "Total water content of the meat and cooking loss cannot explain juiciness of the cooked meat product."

Scientists have machines that can measure tenderness by the amount of pressure needed to pierce a piece of meat, but there is no machine that can measure juiciness. Although a typical steak is about 70% water, juiciness is a human

perception, not a subjective measurement. The AmazingRibs.com science advisor, [Prof. Greg Blonder](#) explains "In a steak, going from 65 to 60% water might be unnoticeable, but 45 to 40% might take you from edible to a cardboard. Beef jerky is still 25% water by weight, but most people would say it was juiceless."

So what influences juiciness?

- Free water in the raw meat.
- Water bound with proteins.
- Where the water is located within the architecture of the muscles.
- Melted and softened fats, especially marbling.
- Gelatinized collagen.
- Saliva which is activated by seeing and hearing sizzle, as well as seasonings, especially salt.

So some juiciness has nothing to do with water. Some meats like pork ribs, pork butt, and beef brisket are often smoked low and slow up to about 203°F, waaaaaay past well done, well into the zone where water is supposed to disappear, and much of it does, especially on the surface as the "[bark](#)" is formed. But these cuts get their juiciness from rendered fat, melted connective tissue, and salty rubs that force you to salivate (see [Meathead's article on meat science](#)).

There are other factors that impact juiciness in steaks:

- Drip loss in the package.
- Cooking method.

- Cooking temperature.
- Meat temperature when removed.
- Breed of the animal.
- Age of the animal.
- Aging of the meat.
- How was it packaged?
- Was it frozen and how it was frozen?
- How was it stored?
- What was it fed?
- How was it slaughtered?
- Was it mechanically or enzyme tenderized?
- Was it cooked with the fat on or off?
- Was the meat brined, salted, or injected?
- What seasonings, spices, herbs, tenderizers, and especially salt (all of which encourage saliva flow) are used?
- Wine!

When you cut into raw meat there is practically zero loss of liquid. Even if you grind meat for burgers there is no real liquid loss. That's because the liquids are bound by proteins and held by capillary action in the thin spaces in the muscle. Raw meat in the grocery display case might have 1 to 3% "drip loss" which is why they put that little absorbent pad under it. Much of this drip loss is due to the rupturing of cell walls while the carcass goes through *rigor mortis*, a shrinking and stiffening of the muscles after slaughter. Within a day, enzymes kick in and begin the tenderizing and aging process and the muscles relax. This is why freshly killed meat can be tough. It is usually best to let it rest a day or three.

If your steaks were frozen, water expands and ice crystals form. Remember the last time you stuck a beer in the freezer and forgot about it? These ice crystals puncture the cell walls and, depending on how the meat was frozen and thawed, another 3 to 5% of "purge" can emerge when your steak is defrosted.

During cooking, according to Prof. Blonder, "The first 'sweat' occurs with water that is very loosely contained between fibers oozing out through relatively wide channels in the meat. Some of it drips off and some evaporates. As the heat increases, more tightly bound water is freed. Then, around 135 to 145°F, the collagen in the connective tissues that sheath muscle fibers and hold together bundles of fibers begin to shrink and eventually soften into gelatin. This squeezes on the muscle fibers, wringing out additional liquid, some myowater, and some myoglobin from burst cells. So the amount of released juices rises as you pass through 140°F. This is why meat cooked to higher temps gets dry."

Depending on how hot and how long you cook a steak, there might be 10 to 25% water loss, mostly due to evaporation and dripping. Let's call it 15%. So a properly cooked steak is down to about 60% water, but most of it cannot escape when the meat is cut because it is bound by proteins and held by capillary action.

SOUS VIDE SUCKS OUT A LOT OF WATER BUT THE MEAT IS STILL JUICY

If you have ever played with sous vide, a very gentle method of precise temp control cooking ([click here to learn more](#)), you know the meat is drowning in water in the bag. The low slow gentle process can pull out a lot of juice. But the meat is exquisitely tender and juicy. So clearly meat can lose a lot of water and not taste dry.

DRY AGED STEAKS DON'T EXUDE ANYTHING BUT FLAVOR

A while back, Meathead had dinner with three friends at David Burke's Primehouse in Chicago (alas, now closed). Chef Rick Gresh served a vertical tasting of 28, 40, 55, and 72 day aged ribeyes. He says they rest for about six to nine minutes in the process of being plated and brought to the dining room under lids. The waiter sliced each steak into 3/4 inch strips so they could all taste each steak. Despite all the cuts, *there was no juice lost. Zero. Zilch. Zip.* The group asked Chef Gresh why and he said "that's dry aging".

Dry aging dehydrates the meat and enzymes change the molecular structure, but even though there was significant water loss due to aging, the meat was tender and juicy. Clearly juiciness is not all about water.

WHY ALL THE BOOKS SAY WE SHOULD REST OUR MEAT

There are several theories for why we should rest steaks and other cooked meats. Let's look at the most popular:

The pressure theory. The most widely repeated theory says that during cooking, muscle fibers, which fans of resting say

are like tiny skinny balloons, shrink along their length and expand across their width. Just like when you see meat "pulling back" along the bone. This puts pressure on the juices between the balloons and at the same time these juices expand pushing even harder on the balloons. If you cut into the meat when it is fresh off the heat, they say the juices come gushing out of the sliced balloons. If you let meat rest and cool, say the resting advocates, water pressure drops, fibers relax, and fewer juices escape. A variation on the theme says that the juices run away from the heat on the side facing the flame.

Not so, says the AmazingRibs.com meat scientist, Dr. Mata, "Water moves back and forth between compartments. It is not trapped in the fibers. Fibers are not balloons." So the pressure equalizes quickly. And at cooking temperatures, water does not expand much inside the muscle. Meat shrinks during cooking mostly because of dripping and evaporation. If the water was somehow pushed into and trapped inside expanding balloons, then, when the fibers cool during resting, they would shrink and *would expel more liquid, not less* as a result of resting. Furthermore, water cannot be compressed by pressure. In other words, this theory just doesn't hold water.

The reabsorption theory. Another theory holds that the outer parts of the meat, which are much hotter than the centers, dry out during cooking making the beloved crust. The hotter you cook, the more gray dried out meat forms directly below the surface. This is less lovable. This is overcooked meat with less flavor, juice, and tenderness. By

allowing the meat to rest, says the theory, these hot dry fibers can absorb some of the liquid from the center, so less liquid will spill out when you cut the meat.

This may be true because systems do seek equilibrium. But the goal of cooking properly is to have a good dark crust and minimize the gray area beneath it. So reabsorption might hold onto a little liquid, but it's not relevant with properly cooked meat with minimal overcooked meat below the surface.

The viscosity theory. This theory is that when the meat is hot the juices are runny and as they cool they get thicker and more viscous. Sounds plausible, but we have never seen any real research to demonstrate this.

WHY WE THINK RESTING IS A MISTAKE

But resting has other impacts, many detrimental.

Cold steak! A very important thing happens during resting: The meat gets cold. There's a reason the serving plates are hot in steakhouses. We like our meat hot. It will cool off fast enough. Why give it a running start?

Overcooked meat! Another thing happens when the meat is resting: Carryover. Depending on the thickness and the amount of energy stored in the outer layer, the center can rise 5 to 10°F or more. That can take your perfectly cooked prime cowboy ribeye to particle board before you know it. And the hotter the center, the less moisture.

Waxy fat! When a steak is hot, the fats are soft, sometimes even runny. They give the meat a rich unctuous mouthfeel and a lot of flavor. Let the meat cool and the fat starts to harden and get waxy. Do you like eating wax?

Soft surface! While resting, the crust of a steak or chop gets soft and wet, especially on the side that is in contact with the plate or cutting board. Spice rubs get muddy. Adam Perry Lang is a classically trained chef and owner of [APL steakhouse and barbecue](#) in Los Angeles as well as [Perry Lang's](#) in Yountville, CA. We asked him to weigh in on this issue and he points out that the *juiciness sensation* also depends a lot on the crust, especially its saltiness. "In the early crust stage (fresh off the grill), fat, collagen, and salt will cause a unique flood of saliva in your mouth. Meathead refers to this type of crust stage as 'alive and snappy'. It is the type of crust that can cause you to eat clumps of fat and chewy sinew with joy that you would not normally eat. We are convinced it is another dimension, or the epitome of *umami* (savoriness). It rarely comes the same way from a rested piece of meat. Finishing salt is also important for this juiciness sensation."

So resting cools the meat, softens the crust, overcooks the center, muddies the spices and herbs, and reduces moisture of steaks and chops, and its impact on the perception of juiciness is probably nil.

FOIL MAKES IT WORSE

A loose tent of foil is often suggested during resting. Not only does it not help, it hurts! It does prevent a little heat

from escaping, but not much. Foil is a lousy insulator. If you take a dish that has been cooked under foil off the heat, in seconds that foil is cool enough to handle. The problem with foil is it traps steam and softens the crusty surface of the steak that you worked so hard to create. And never wrap cooked meat tightly in foil. Juices really come gushing out then.

ATTEMPTS TO PROVE THE IMPORTANCE OF RESTING

To get a handle on how much leakage occurs with and without resting, one would have to do carefully controlled lab experiments and repeat them multiple times on different cuts from different animals. But remember, that is only a measure of water loss, not juiciness!

Food scientists use centrifuges, nuclear magnetic resonance relaxometry, and other high tech tests. But that hasn't stopped cooks from attempting to get a measurement.

PROF. BLONDER'S EXPERIMENTS ON STEAKS

We asked Prof. Blonder to look into the matter

He started by taking two 13 1/2 ounce ribeyes, each 1 1/2 inches thick, salted them with 1/3 teaspoon of table salt per pound, and let them sit for an hour or so in the fridge. This technique is called dry brining and is known to help the proteins retain moisture as well as improve flavor. He then cooked them to 125°F, medium rare, using the reverse sear

method we recommend because it produces more tender and less overcooked meat.

He immediately cut one steak into strips, collected the juices in a paper towel from the cutting board and the meat surfaces, weighed the towel on a sensitive scale, and subtracted the towel's dry weight. The "not rested" steak expelled about one ounce by weight through the whole process, most of it on the cutting board. Remember, the raw steak weighed 13.5 ounces.

Within five minutes juices started emerging from the "rested steak" which sat for 30 minutes before Blonder cut it up. After he cut the meat up, he collected the juices, most of which were on the meat surface not the board, and weighed them. The total was about 85% of the one ounce collected from the not rested steak. An insignificant difference. Also, the meat temp rose to 145°F from carryover cooking, well past medium rare. Carryover could explain the fewer juices since the warmer meat is, the fewer juices it discharges. Not much juice left in a well done steak. Is this the reason people think resting meat preserves juices?

To make sure his data was correct Blonder repeated his tests. Same results. And remember, Blonder did something most adults don't do. He sliced up the meat all at once. So by this measure alone, resting meat has no significant benefit.

Not Rested



Rested 30 Mins (115F)



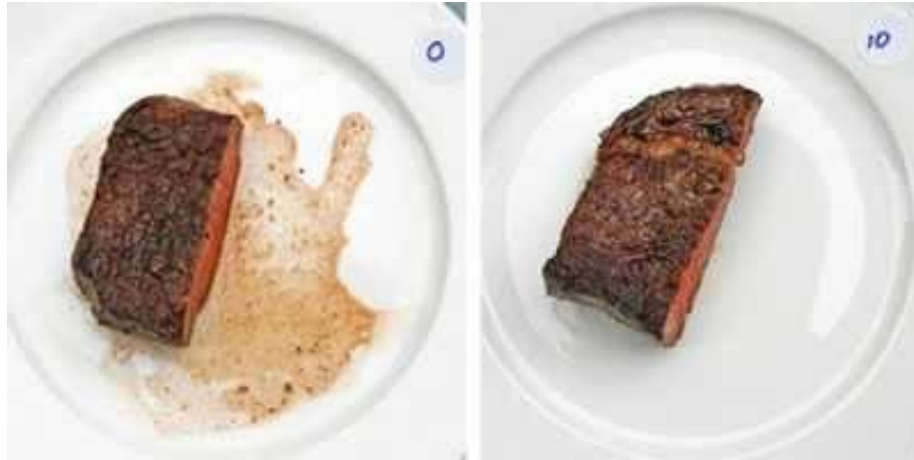
27 gms juices



23 gms

J. KENJI LÓPEZ-ALT'S EXPERIMENTS ON STEAK

At [SeriousEats.com](https://www.SeriousEats.com), the brilliant chef [J. Kenji López-Alt](https://www.SeriousEats.com) took a serious stab at testing the resting theory. He took six steaks, raw weight of about 17.6 ounces, pan seared and oven finished and cut one in half immediately, and others at 2.5 minute intervals. There was no carryover cooking. Below are an unrested steak, and one rested for 10 minutes. You can clearly see the rested steak has spilled less liquid.



He then dried the surfaces of the cut steaks, and weighed the meat. The weight loss from an unrested steak was 6% greater than a steak rested for 5 minutes, just less than 2.5 tablespoons, or less than 1/10 teaspoon per bite.

Of course much of the juice on the surface of the meat is ingested, and most of us don't begin eating a large steak by cutting it in half. The amount of area exposed by the cut is vital to determining how much spill there is. Most of us cut off a bite sized chunk from an edge, exposing much less surface area which is cooked more and will spill less. If you think about the time lapse between moving the steak from cooker to table, and from first cut to the second, five minutes can easily pass. If you mop up the juice with meat on your fork, in the real world, there is little to be concerned about and nothing is really lost.

HELEN RENNIE'S EXPERIMENTS ON STEAK

A computer scientist and food blogger from Boston, Helen Rennie, ran a test similar to Lopez-Alt's. She also cut the

steaks in half but she measured the juices by pouring them off the plate. She found little difference in juices lost. Pouring juices off the plate is probably not the best method to assay juice spillage since there is inevitably juice left clinging to the plate.

HESTON BLUMENTHAL'S EXPERIMENTS ON STEAK

The great English Chef Heston Blumenthal attempted to demonstrate the necessity of resting steaks by cooking two steaks in a pan. He immediately placed one on a plate, covered it with a sheet of Plexiglas, and had his very large assistant, Otto, smash it under foot. He poured the liquid off the plate into a shot glass. He got about two tablespoons. He let the other steak rest for five minutes and then gave it the Otto treatment. Only a few drops emerge.



So the difference was a 1/2 an ounce by volume (also about 1/2 ounce by weight) from a whole steak that probably weighs 10 to 12 ounces total. If you cut this steak into bites,

failure to rest might cost you one or two drops of juice per bite compared to a steak stomped on by Otto. Blonder points out that, as steaks rest, the juices get slightly more viscous, so perhaps the amount of juices recovered by Blumenthal is simply a matter of fluid dynamics. The thicker juices are just sticking to the meat. Maybe the real message is to keep Otto out of your dining room. You can watch his demonstration at about 2 minutes 50 seconds into [this video](#).

WHAT DOES HAROLD SAY?

Here is what the eminent food scientist Harold McGee says in his foundational book *On Food and Cooking: The Science and Lore of the Kitchen*: "Large oven roasts should be allowed to rest on the countertop for at least half an hour before carving, not only to allow the 'afterheat' to finish cooking the center, but also to allow the meat to cool down, ideally to 120°F/50°C or so... As the temperature drops, the meat structure becomes firmer and more resistant to deformation and its water holding capacity increases. Cooling therefore makes the meat easier to carve and reduces the amount of fluid lost during carving."

He makes no mention of steaks, only *large* roasts. And, while much of the book is footnoted with references to research, there are no footnotes on this passage. Blonder has proven that a slightly greater amount of liquid may come out of a roast, but it is a small percentage of the total liquid, and it is not "lost". It is reabsorbed when poured over the meat. And remember, juiciness is only partially dependent on the myowater and in the meat. So now we know that the only

remaining reason for resting is to make a large roast easier to carve. But what about steaks?

LET'S GET REAL: HOW DO YOU EAT?

Let's forget all the science now and just think about how we eat. Let's be conservative and say a finished steak is about 60% water after drip loss, purge, and cooking. That means that, in a 12 ounce steak, seven ounces are liquid. That's almost a cup. So let's say we pull our nice big thick juicy medium rare steak off the grill and cut into it. Out come some juices. At most a teaspoon out of 12 ounces of steak that is seven ounces of water.

Do you let those juices sit on the plate and waste away? Heck no. You mop them up with the meat on your fork! The meat is absorbent now that it is no longer saturated with water. Nothing is lost!

Do you inhale the whole steak immediately? Heck no.

It takes a few minutes to get it off the heat and to the table. Then it takes *at least* 15 minutes to eat it. The fact is, by the time the steak comes off the heat til you get two or three bites in, have a bit of potato, a bit of the green beans, a sip of wine, a little conversation, the meat has had plenty of time to rest, and not a drop of fluid is wasted because when you are done, your plate is clean. And the steak was hot and crisp when you cut into it.

Look at the two plates at the top of this section. No juices left behind! The plate on the left shows juices from a steak that

did not rest. The plate on the right held a steak that rested 15 minutes. Not much waste is there? That's because Meathead and his wife mopped up all the juice they could with the meat on their forks. (The slight color difference is because one steak had a tiny bit of char on some of the fat and it colored the juice.)



Thick, dry-aged porterhouse is the specialty of the house at one of the most beloved beef emporia in the nation, [Peter Luger Steakhouse](#) in Brooklyn. It is cooked under a screaming hot gas broiler to medium rare, and then, to halt the carryover cooking, the two sections are sliced from the bone, and sliced again into hunks so several people can share it. It is served swimming in its juices and clarified butter. See

those spoons in the picture above? They are for saucing the meat on your plate with the buttery juices in the platter. We sincerely doubt any steak has been sent back to the Peter Luger kitchen for being too dry.

WHAT ABOUT ROASTS AND LARGE CUTS?

Because a beef rib roast, pork loin, or turkey breast can be so much thicker than a steak, when you slice them there is much more surface area to leak juice. So the amount of juice exuded from a roast can look alarming.

Will more liquid flow without resting? Blonder says "no". By slicing right away we get to serve perfectly cooked hot meat. We collect the juices from the cutting board and pour them over the meat on the serving platter. Most of the juices are re-absorbed. Or we make a board sauce (especially on leg of lamb). This is a great way to use the juices and add some excitement. Trust us, we never serve improperly cooked or dry roasts.

The best reason Blonder sees for resting a big roast like a prime rib is that it stiffens slightly and is easier to carve, as described by Harold McGee. A sharp knife solves any cutting issues.

HOLDING MEAT LIKE BRISKET IS NOT THE SAME AS RESTING MEAT

Remember:

Resting is the term for letting hot meat cooked to normal temperatures cool as discussed above. Typically these are meats cooked to 165°F or below.

Holding is the technique of letting meat cooked well past well done stay warm for a while after cooking. Typically these are meats cooked in the 195 to 205°F range, like beef brisket, pork butt, and ribs.

In restaurants brisket, pork butt, and ribs are often removed from the 225°F oven, wrapped in foil or plastic wrap, and placed in a warming oven to hold for a few hours at 170 to 180°F. Some of these ovens even have humidity control. In competitions the meats are often wrapped in foil and then towels and placed in an insulated box like a Cambro or faux Cambro.

These are very different meats than steaks and chops. They are really tough cuts with lots of fat and connective tissues that need to be cooked to a high temp to make them chewable. A steak cooked to 203°F would be inedible, but a brisket is at its best at about that temp. Rendered fat and gelatin from connective tissues provide most of the juiciness. In fact they often can lose up to 30% of their weight during cooking, most of that "drip loss" is water that has evaporated from the surface.

During the holding period, very gentle slow carryover cooking continues to cook the meat and tenderize it as it cools slowly, and it rarely is allowed to cool to less than 180°F, much hotter than a medium rare steak or even a turkey.

Because these meats have been cooking for 8 to 12 hours, the surface has become dry, forming a jerky-like bark. What water is left is in the center. By wrapping it so no more water will evaporate, and cooling it slightly, that water can move back into the parched areas.

The problem is that if you let it go too long, it can soften the bark too much. It is a balancing act, and that is why top cooks are called Pitmasters.

THE BOTTOM LINE

- 1) The difference between the amount of juice spilled with resting and without resting is insignificant especially when one considers that juiciness depends on many other factors such as water that remains bound with proteins, melted fat, collagen converted to gelatin, and even saliva.
- 2) Far more important than resting the meat is cooking it to the right temperature. Once you get beyond 140°F, the moisture from water in any meat drops precipitously. The ultimate folly is the diner who orders a medium steak (140°F) and insists that it rest for 20 minutes. As meat sits around it can easily overcook from carryover. The best way to make sure you cook it properly is to use a quality digital thermometer. We cannot stress this enough. Follow the link and buy one that we have tested and recommended.
- 3) Season your meat properly with adequate salt, then, when the meat hits the proper temp, dive in while it is hot and crisp! Sizzling crisp crust is a major pleasure factor, perhaps more important than the small amount of water spilled. Chef

Dave Arnold, author of the blog [Cooking Issues, The International Culinary Center's Tech 'N Stuff Blog](#), says "Extra juice makes meat taste watery and bland. Moisture isn't necessarily your friend; delicious is your friend."

4) Juices lost in the grocery case, after thawing, and during cooking are far greater than those spilled after cooking.

5) In tests like Kenji's, five minutes rest was all that was needed to stanch most of the flow. In Blonder's tests, resting made no significant difference. If you still think resting matters, be assured your meat will rest enough while you move it from cooker to the table, while you wait for everyone to be seated, while you taste all the other foods and drinks, and by the time you're into it more than a slice.

After this article was published, Kenji proposed a very clever compromise: "I cook the meat, then let it rest. Just before serving, I flash it on the hottest fire I can muster for about 15 seconds per side. If I'm cooking indoors, I sear the steak in hot fat, then let the meat rest on a wire rack set in a rimmed baking sheet. Then, just before serving, I reheat the fat and juices left over in the skillet until they're smoking-hot and pour them right over the steaks—you'll see them sizzle and sputter as they crisp up. This is similar to the restaurant hot-oven flash, but it works even better: Hot fat is a more efficient means of heat transfer than hot air, which means faster crisping with less chance of overcooking. It also adds a final shot of flavor to the surface of the steak." [Click here to read the rest of this thoughtful article.](#)

6) But most important, leave no juices behind! Blonder proved that meat will soak up almost all the juices spilled, rested or not. Pour the juices over the steak, and mop the rest up with the meat on your fork, with potatoes, rice, bread, or make a board sauce with it. Look at the picture at the top of this section. That should end the debate.

This myth is busted. Like the other myth that won't die, resting before swimming, when it comes to all this talk about resting meat, We say give it a rest, stop crying over spilled juice, and clean your plate like Momma told you. About that, she was right!

EXTREME STEAK: WILD AND CRAZY WAYS TO GET A KILLER SEAR



Now you know the importance of getting a good sear on the exterior of meat: Searing and browning creates flavor. To get that all-over flavor on a seared steak, here are some offbeat methods that work amazingly well:

THE AFTERBURNER METHOD

One night Meathead was doing some 3/4 inch ribeyes. He started some charcoal in a chimney to toss on his trusty Weber Kettle because he wanted max heat for that great dark whiskey colored exterior.



When he looked at the chimney, he noticed it looked like the afterburner of a fighter jet. Big blue and red flames rolling around, hardly visible. So he put a cast iron frying pan on top and read the temp in the pan with an [infrared laser thermometer](#). Almost 800°F! Then he took the pan off, put a wire rack right on top of the chimney, and tossed the meat on the rack.

Perfect dead on sear, deep mahogany brown, in less than three minutes per side and cooked to a perfect medium rare in the center!

Top of the page you can see Meathead cooking some 3/4 inch ribeyes on the afterburner. Thanks to Rob Lusk for the great photo, taken on steak night on the [Pitmaster Club Meat-Up in the Bahamas in 2017](#).

Now keep in mind that cooking at Warp 10 is not right for all steaks. It works best only on steaks 1/2 to 3/4 inch thick. It is ideal for skirt steaks for fajitas. Anything thicker and it will burn them before they cook in the center. The secret is that it puts massive amounts of heat on one surface at a time and cooks the surface so quickly that the interior doesn't get too hot. At lower temps the heat progresses through the surface to the interior, and by the time you have a good dark sear on the outside, the inside is overcooked. That's the problem with fajitas. You have such a tasty piece of meat in the skirt steak, but the center is almost always grey. Use the afterburner, and nevermore.

A few tricks: You will need only half a chimney of charcoal. Make sure to salt the meat but don't pepper it. The heat will carbonize the pepper and make it bitter. Make sure you pat the meat dry first otherwise it will steam the surface. In fact, if you want to paint the surface with a little oil, that will help crisp it even more. When the meat is on, move it around a bit because the wire grate can brand the meat with some serious black grill marks, too black. Just make sure you have all the side dishes cooked before you put on the meat because it cooks in about 2 to 3 minutes per side. For slightly thicker

steaks, you can cover them with a metal bowl so the meat will cook from the top by convection.

Postscript: We're huge fans of Alton Brown, and readers have pointed out that in a 2010 episode of his Food Network show, titled "[Porterhouse Rules](#)" he attempted to duplicate the extreme heat that steakhouses use to *broil* steaks with heat from *above*. He took a chimney, fired it up, lifted it, dusted off the grate, placed the steak on the grate, placed the chimney above the steak, cooked for 1 minute, flipped the steak and repeated. Well we tried this and, as AB warned, the steak got a light dusting of ash and a coal fell onto it. Sorry, AB, our method is better. You can flip the steaks often on top, and there is no ash.

THE VIGNERON METHOD

Then there is a method we call the vigneron method. Meathead learned it when visiting wineries in Bordeaux, the French region that makes wine perfectly suited to steaks.



In the winter, vineyard owners prune away most of the branches, called canes. They then have huge piles of grapevine wood, most of it about the thickness of a pencil. During the fall harvest season vigneron, grape growers, will take a big stack of dried canes, and set them on fire. They quickly burn down to a glowing mound, and the workers grill meats over the scorching hot embers. The flavor is exquisite. His hosts called this method *sarment* (pronounced sar-MOHN).

In many states in the US grapevines abound, growing wild in the woods and on fences along roadsides. You can harvest grape cuttings there. To ensure a steady flow of grape wood, Meathead planted five Himrod vines (the best green table grapes he's ever tasted). He gets enough fruit for a few snacks and enough wood for about three cooks. He's also

done this with twigs from his neighbor's cherry tree. Of course his neighbor expects to be fed in exchange.

To start, take out the bottom grate from your Weber Kettle or other charcoal burner and open the lower vents. Crumple two sheets of newspaper and put them in the bowl. Then stuff as many dried vine prunings as you can fit on top of the paper, all the way to the level of the upper grate. On goes the top grate. Light the paper through the bottom vent holes, and the whole thing goes poof in about two minutes with very impressive 5 foot flames. Beware of melting any television cables that may be running overhead.

Within a few minutes, you will have glowing white hot embers. But the embers are gone in a hurry because the canes are about the size of kindling. You've got a window of about 15 minutes between the time the flames disappear and the embers go cold. Wait until you can no longer see yellow flame, then scrub the grate and on goes the meat.

In France, Meathead also had small butterflied quail over grape wood, but when he tried the method at home with Cornish game hens he completely blackened them. The skin is too fatty. Even though they're smaller than standard broiler chickens, Cornish hens are too thick, so steer away from poultry. He now uses this method primarily for flank steaks because they are about the right thickness, under 1 inch, and beef loves heat and smoke. Just pat the surfaces dry so they don't steam, and use only salt. Pepper just scorches. Never any marinades. They just steam the meat.

Leave the lid off, turn the meat every minute or less, and it's usually done in less than 10 minutes. The burning fruitwood creates temps in the 800 to 1,000°F range and gives beef a fine flavor. That's Warp 10, Mr. Spock.

[Here's a video of the Vigneron Method on a flank steak.](#)

CAVEMAN STEAKS

Here's a showstopper. A bit of a parlor trick, but we know you will want to try it. Once you get your fire down to glowing embers, take a magazine and fan the coals so any loose ash is blown away.

Take a steak about 1 inch thick, pat it really dry, salt it, and lay the meat right on the coals. You heard me. *Right on the coals.*

Surprisingly, when you turn it in about three minutes, there will be very little ash stuck to the meat, and it produces a very dark all-over sear in a hurry. But the operative words are *very little ash*. Every time I've tried it, small amounts of ash and even whole coals have stuck to the surface and there have been scorched dry spots. The ashes are easily brushed off, but we still can't recommend this method wholeheartedly. It is much better to place a wire rack on top of the coals or very close to them. Then you can check the meat, and there is less scorching and no ash. Live in the stone age if you wish, but know things are better in the iron age.

Here's a slight improvement. Lay a grate on top of the coals and put the meat on the grate. No ash, no burn spots.



THE STRIPSTEAK METHOD

In the Mandalay Bay Hotel in Las Vegas, [Chef Michael Mina's Stripsteak](#) uses a clever technique for reaching perfection on thick steaks.



Stripsteak begins by immersing the meat in baths of clarified butter at about 120°F. This is technically sous vide but directly in butter instead of vacuum packing the meat in plastic bags. Clarified butter is unsalted butter that has had the water and milk solids removed. It is also called ghee. Click the link for info on how to make it.



After about an hour the meat is an even 120°F throughout, and when an order comes in, the chef lifts it gently from the butter, shakes a bit off, turns around, and lays it on a screaming hot topless Santa Maria style grill burning mesquite logs.

After a few minutes and several turns, the meat comes off the grill a deep dark almost black, but never burned, and the center is perfect medium rare, about 130 to 135°F, with almost no color variation.

Interestingly, the butter does not penetrate much so the butter flavor is minimal. It does contribute to a deep brown

nutty crust, however. The steaks are among the finest I've ever tasted.

ARE YOU READY FOR A STEAK COOKOFF?



B y Clint Cantwell, Senior VP of Whatever,
AmazingRibs.com

So you think you make a great steak?

The true test of your talent is one of the hundreds of steak cooking contests held each year. There are two sanctioning bodies, the [Steak Cookoff Association](#) (SCA), founded in 2013, and the [Kansas City Barbeque Society \(KCBS\) National Steak Championships](#), launched in 2021.

The first barbecue competition was the Kaiser Foil Cookoff conducted in 1959 in Hawaii, just a few months after Hawaii became a state. “For Men Only” contestants sent in their main dish recipes, 25 finalists were chosen and flown with their wives (assuming they were all married) to the Hawaiian Village Hotel on Waikiki for the cookoff.

After that event there were a scattering of outdoor cookoffs, and then, in 1985, in Kansas City, MO, Carolyn and Gary Wells and their friend Rick Welch had an adult beverage inspired brainstorm. They formed a club for barbecue lovers, called it the [Kansas City Barbecue Society](#), and today there are more than 500 KCBS sanctioned competitions across the continent where backyard braggers could see just how good their game is by cooking pork ribs, pork butt, beef brisket, and chicken.

The prize money has skyrocketed and so has the cost of competing, entry fees in the \$200 to 350 range, fancy cookers that cost up to \$10,000, wagyu brisket at \$200 a pop, a trailer with a mobile kitchen, etc. It is now a rich man’s sport that takes at least two days not counting advanced prep and travel.

But steak competitions are a whole different kettle of beef.

A few years ago, I decided to throw down and entered my very first SCA contest in my hometown of Memphis. From the jump, I could see why so many KCBS competitors have fallen in love with steak cookoffs.

First, the entry fee was fairly reasonable at \$150 and that included the steaks that were provided (although entry fees and prize money vary depending on the organizer). Second, this was a one-day affair so I wasn't losing my entire weekend. Last, everything I needed to compete fit in the back of my car. For the steak cookoff, my equipment list included:

- One charcoal grill (I used a Weber kettle but many of the top competitors swear by [PK Grills](#) or [Hasty Bake](#))
- A couple chunks of smoking wood (I used cherry for)
- A single bag of charcoal (after all, I was only cooking 2 steaks hot and fast)
- [A charcoal chimney](#)
- A 10x10 pop-up canopy
- [GrillGrates](#) (tm) brand grates (another must according to the steak pros)
- Scissors, a paring knife, and tongs
- A [Thermapen](#)
- A 4-foot folding table
- A small cooler for the steaks
- A second cooler with some beverages
- Kitchen twine
- Salt and seasoning for the steaks
- And some Irish butter to finish the steaks

With the car packed it was off to the contest. Once I arrived, it only took a couple minutes to get set up, giving me plenty of time to say hi to some old friends before it was time to select our steaks during the 10 a.m. cooks' meeting. After the head judge went through [the SCA rules](#), each team drew a number out of a bag to determine the order in which steaks would be selected. In front of us were two tables filled with beautiful boneless ribeyes approximately 1 1/4 inches thick (steaks used in SCA contests are at least 1 1/8 inches thick and are [USDA Prime or USDA Choice](#) grade). Going in order, teams were allowed to select their two favorite steaks based on thickness, overall shape, marbling, and hard fat.

After my steaks were selected (roughly in the middle of the pack), I took them back to my site and began prepping them. This included removing any remaining silver skin, trimming off a little of the hard fat, tying twine around the steak to create a more uniform shape so the steak cooks evenly (this is a trick I picked up from another competitor, see the photo below); and seasoning the steak with a simple rub consisting of Morton Coarse Kosher Salt, ground black pepper, onion powder, garlic powder, and a little paprika for color. Normally I would add some porcini mushroom powder as well for a hit of umami, but after many years on the competition BBQ circuit I learned that there is a reason teams tend to paint within the lines and with the same boring colors – because creativity rarely wins! I then placed the steaks in the cooler until ready to cook. Since the turn-in window didn't open for a few hours (2:00 to 2:30 p.m.), I had time to kick back and enjoy the company of my fellow cooks.



At 1 p.m. I got the charcoal going. Once it was ashed over I set up the grill for 2-zone cooking placing the pre-heated briquets on one side of the grill's charcoal grate and leaving the other side empty. I then added 2 chunks of smoking wood on the charcoal, added the main grill grate, then placed my GrillGrates on the hot side. While normally I would use the flat bottom of the GrillGrates for cooking steak as that allows me to get more browning and flavor across the entire surface of the meat, I was informed ahead of time by my unnamed mentor that judges actually prefer to see crosshatch grill marks that GrillGrates do so perfectly when used as originally designed.

At about 1:40pm, I added the steaks to the cool side of the grill to begin the reverse sear cooking process. Once the steaks reached an internal temperature of 115°F, I removed them and got the grill as hot as possible before searing the steak on the GrillGrates, rotating 1/4 turn halfway through on each side for the perfect diamond pattern. On the advice of my mentor, I did something I would NEVER do at home...I cooked the steak to 135°F for a perfect medium which like the crosshatching is what the judges are looking for. Once the two steaks were done, I gently removed the twine then brushed them with softened unsalted Irish butter. About 5 minutes from the close of the turn-in window (I am notorious for turning food in during the very last seconds of the window), I selected the best of the two steaks and placed it on a round silver disk in a Styrofoam clamshell. Note that competitors are not allowed to do any trimming or slicing once the steak is cooked -- it must be turned in whole. Steaks are then judged blindly (i.e. there are only randomized numbers on the Styrofoam box so judges cannot tell which team turned in which steak) based on Appearance, Doneness (Medium), Taste, Texture and Overall Impression. Steaks can be disqualified if there are any foreign objects like a piece of twine in the box, if it is turned in after the turn-in window has closed, or if the steak turned in isn't one of the ones distributed by the organizers.



Once my steak was dropped off at the judges table, all that was left to do was to repack the car and wait for awards.



At roughly 5 p.m. everyone gathered for the awards ceremony and after trophies and checks were distributed for 2 ancillary categories that I did not enter, the organizer called out steak winners from 10th place down to 1st. Suffice

to say, I did not hear my team's name called but I did learn that not only did the first place winner get a nice check and trophy, they received a "golden ticket" that allows them to compete at the SCA World Championship, the largest steak cookoff in the world held each year in Fort Worth, TX.

A few minutes later we each received a score sheet revealing all the team scores and everyone set off to unwind at home and start strategizing for their next SCA contest. It turns out I actually placed a very respectable 12th out of 34 teams.

While I have yet to do another SCA contest, I definitely understand why so many folks can't get enough of them. Steak cookoffs are relatively inexpensive, fun, and done in a single day. If you have always been intrigued by the world of competition cooking but are apprehensive to put the time and money into a multi-day BBQ contest, I would whole heartedly suggest giving one of these steak cookoffs a shot. You can find all upcoming contests [here](#) or SCA provides the tools necessary to actually organize your own!

PART VII

RECIPES

Now that you have the basics down, here are some of our favorite recipes. But first a few tips.

Tinkering. We know you like to tinker. *Do us and yourself a favor, try our recipes our way with no changes the first time.* You will then have a memory of what the recipe is *supposed* to taste like.

If the recipe calls for regular old fashioned granulated white sugar, don't use brown sugar. If it calls for boring old distilled white vinegar, don't reach for the cider vinegar. We worked very hard to perfect and test these recipes and some substitutions just don't work. After you've tasted the dish the way we intended it to taste, then the next time you make it, riff on it however you want.

Here are some key steps to creating a successful dish.

Timing. Prep times include all the washing, measuring, chopping, and peeling. Cooking times are our best

guesstimates based on our tests, but keep in mind, this is food, not a widget, and two seemingly identical chickens may cook at different rates. No two cookers are exactly alike. Weather, humidity, and wind also impact outdoor cooking times. [Click here to read more about what influences cooking time.](#)

Wood. We have not specified precisely how much wood you will need or what type of wood to use for smoking because the strength and flavor of wood depends on many variables, including the nature of your cooker and your preferences. Go easy at first. A meal is never ruined by too little smoke. Measure wood and keep records with a cooking diary ([you can download one here](#)).

2-zone almost everything. For most recipes on a grill, we recommend 2-zone cooking. *The indirect convection heat zone is for slow roasting and smoking.* It is cooler and acts as your safe zone for when pieces finish early or if they are cooking too fast. Whenever cooking over indirect heat, we always specify an air temperature, usually 225°F or 325°F. You need a good digital oven thermometer with a probe placed on the cooking surface near the food. A thermometer in the dome cannot be trusted.

Over the direct infrared radiant energy zone, we want lots of fire power for searing. “Give ‘er all she’s got, Scottie.” For searing, we usually do not specify the temperature because most cooking thermometers cannot go high enough and infrared radiant energy is best measured in calories rather than temperature. Moreover, the direct radiant heat side is usually only being used for searing and browning the

surface. The food isn't there for long. We sometimes call cooking by direct infrared radiant heat Warp 10, Warp 9, Warp 8, etc. in homage to Star Trek.

Lid position. Almost all the recipes in this book require you to cook, roast, bake, and smoke with indirect convection heat with the lid down. In most cases when we ask you to sear, the food is over direct infrared radiant heat, and the lid is up.

Some recipes call for cooking in a pan or pot. You can do that on the direct heat side or on your side burner, or, horrors, indoors. We strongly recommend that you have a frying pan and a sauce pan set aside just for outdoor cooking. You can cook with your best expensive pots and pans, but sometimes they fall, or get scorched, and we don't want to risk the wrath of a spouse by ruining a wedding gift.

Salt. We use Morton Coarse Kosher Salt. No Morton did not pay us. Different salts have different grain size and that can influence salinity when measured by volume (teaspoons, tablespoons, cups) rather than weight. We wanted to standardize on one salt, and the grain size of Morton Coarse Kosher Salt makes it easy to pinch and scatter. If you substitute table salt, cut the quantity in half since it is more concentrated. [Click here to learn more about the science of salt and see a conversion calculator for different salt types.](#)

Black pepper is always best when ground fresh. Ditto for other spices that start out as seeds.

Butter is usually unsalted in our recipes. We prefer to control the salt content precisely without the wild card of an unknown quantity coming from the butter. That said, if you

use salted butter, there is so little that the recipe will probably turn out fine, especially if you cut back a tad on other salt.

Eggs are large.

Flour is all-purpose flour.

Fruits and vegetables are medium size, and they should always be fresh and scrubbed with cool water.

Garlic powder is pure garlic powder, never garlic salt, which has salt in it. You should control salt separately.

Mayonnaise. Never substitute Miracle Whip or light mayonnaise for mayonnaise. The chemistry is very different. Among other things, Miracle Whip has two kinds of sugars, mayo has none.

Milk is whole milk. You can get away with 2% in many cases, but not skim milk, soy milk, almond milk or any other substitutes. If we call for half-and-half or cream, it is because we think the fat is important to the chemistry. You can probably substitute one for the other, but don't use milk.

Oil is usually olive oil unless otherwise noted and is usually extra-virgin olive oil if it is not being heated. If it is being heated, use inexpensive olive oil or vegetable oil.

Sugar is granulated white sugar. Sugar is a common ingredient in spice blends and sauces because it is a flavor enhancer, it helps browning, and it encourages crust formation. When we want brown sugar, we will call for it.

Ingredients are listed in the order in which the recipe calls for them. If you see the term “divided” it means that the ingredient will not be used all at once.

Mise en place. Always practice *mise en place* (i.e. putting everything in its place). Gather all your ingredients and chop, slice, and dice before you apply heat to anything. You don't want to be scrambling to chop an onion while things are cooking in the pan. This is a vital foundation level concept.

MRS. O'LEARY'S COW CRUST



Catherine O'Leary was a humble Irish immigrant living on Chicago's near Southside. Late in the night of October 8, 1871 her barn caught on fire, and the conflagration spread on the wings of high winds through thousands of wooden structures. More than 2,000 acres were

destroyed and 90,000 were left homeless. The *Chicago Tribune* reported that the cause of **The Great Chicago Fire** was Catherine's cow Daisy kicking over a lantern.

Years later the story's author admitted he made it up, but Mrs. O'Leary's cow continues to take the rap. So we have named this rub after her to help rehabilitate her reputation.

Most spice rubs are a mix of herbs and spices and we rub them into the meat before grilling ([Click here for The Science of Rubs](#)). This beef rub starts out that way, but then we transform it into a thick paste. The idea is, by mixing spices in water we can extract more flavors and get them into the little pits and cracks on the surface of the meat. Normally marinades and rubs don't go very deep into the meat, but they can seriously change the composition of the surface, and the use of water fills the microscopic gaps on the surface with flavor, and enhances browning and crust formation.

Since there is no salt in this recipe, ([click here to read why our rub recipes do not have salt](#)), salting the meat first is a must. Salt will penetrate deep into meat so you should get it on in advance, perhaps overnight. The rest of the spices and herbs cannot penetrate very deep, so the rub can go on anytime, even just before you start cooking. The general rule of thumb is 1/2 teaspoon Morton Coarse Kosher Salt per pound of meat (don't include bone, and ribs are about half bone).

Makes: About 1/4 cup

Takes: 15 minutes

- 2 tablespoons ground black pepper
- 2 teaspoons dried rosemary leaves
- 2 teaspoons dried thyme or oregano
- 1 teaspoon garlic powder
- 1 teaspoon onion powder
- 1 teaspoon **American paprika**
- 1/2 teaspoon chipotle or cayenne powder

About the rosemary. You can leave the leaves whole or break them a bit with your hands. I throw them into a mortar and pestle and crush them just a bit to release their flavors. If you have fresh, double the quantity and coarsely chop it.

About the chipotle. Don't be a wuss. This is only 1/2 teaspoon for 10 pounds/4.5 kilograms of meat, and it is all on the surface, not the interior. Like a viola, you don't notice it, but take it out of the orchestra and something is missing.

Optional. Add 1 tablespoon ancho chile powder to the dry mix and/or 2 tablespoons prepared horseradish to the paste.

Optional. If you'd rather not make this rub from scratch you can click this link and buy **Meathead's Amazing Smoked Red Meat Seasoning & Dry Brine** instead. It is very similar. Keep in mind that our bottled rubs have salt in them. When using the bottled rub with this recipe, you do not need to add the salt that is called for in the recipe.



Method

1| Prep. Mix everything together in a bowl.

2| Storing the rub. If you are not using immediately, store in a jar for use later or proceed to the next step if you plan to use it now.

3| To use. Dry brine the meat hours in advance. When it is time to use the rub, you can use it straight, or mix 1 part of the dry rub with 1 part water to make a paste. (Note: You can use oil, but the herbs dissolve better in water). Pat the meat dry with paper towels, pour the paste on and rub it in. You can cook right away.

BIG BAD BEEF RUB



This is a simple beef rub recipe, creating a rich, flavorful, crunchy crust on steaks, also called the bark or Mrs. Brown on brisket and beef ribs.

This rub is quite different from a pork rub. Pork loves sweetness, and the best pork rubs have a fair amount of sugar in them, like [Meathead's Memphis Dust](#). Beef doesn't take as kindly to sugar, so there is less here. Black pepper, on the other hand, works wonders when seasoning beef.

You can make this dry rub recipe days or weeks in advance. It makes plenty, and you can just put any extra in a clean jar or zipper bag for use at a later date.

Makes. About 1/2 cup

Takes. About 10 minutes

- 3 tablespoon coarsely ground black pepper
- 1 tablespoon granulated white sugar
- 1 tablespoon onion powder
- 2 teaspoons mustard powder
- 2 teaspoons garlic powder
- 2 teaspoons American chili or ancho powder
- 1 teaspoon chipotle or cayenne powder

About the black pepper. Lately we've been grinding our black pepper and then sifting it. We use the coarse stuff, and put the fine stuff in a pepper shaker.

About the chile powders. We're looking for complexity with two different flavors and two different levels of heat. Most American chili powders and ancho powders do not have a lot of heat, but good flavor. In fact, ancho is usually in a lot of

American chili powders. Go with ancho if you can find it. It has a nice raisiny character. With chipotle or cayenne we're after a kiss of heat. Chipotle has better flavor though.

Optional. If you'd rather not make this rub from scratch you can click [this link](#) and buy [Meathead's Amazing Smoked Red Meat Seasoning & Dry Brine](#) instead. Keep in mind that our bottled rubs have salt in them. When using the bottled rub with this recipe, you do not need to add the salt that is called for in the recipe.

Method

1| Stir it up. Mix the ingredients together in a bowl. Store the rub in a tightly sealed bottle in a dark place. It will slowly start to decline in quality after a few months but should be fine up to a year later. Taste it first.

2| Salt the meat. If your meat has not already been pre-salted, shoot for about 1/2 teaspoon of Morton Coarse Kosher Salt per pound of meat and apply it heavier on thick spots. When possible, apply the salt the day before, but even an hour or two is enough to get it moving inward, and the AmazingRibs.com science advisor [Prof. Greg Blonder](#) has shown that when the meat heats, the salt moves deeper and faster. Click here to read more about this process, called dry-brining.

3| Apply rub. You can apply the rub in advance, some people like to apply it the night before, but the fact is, most molecules in the rub are too large to penetrate more than a fraction of an inch, just like [marinades](#). And they don't have the electrical properties that salt has. The rub is mostly a surface treatment for flavor and [bark](#). So you can apply the rub just before cooking if you wish. Moisture and oils will mix with the spices

and herbs, heat will work its magic on them, and all will be wonderful. We like to lightly wet the surface with water before the rub because many of the flavors in the rub are water soluble. Spread the rub generously on thick beef steaks and brisket, using a bit less on thinner cuts.

Also, be aware that the drippings from a salted meat for use in a gravy or *jus* will probably not need salting, so be sure to taste before you add salt. Remember, you can always add salt, but you can't take it away.

COWBOY JAVA RUB

*L*egend has it that cowboys on the trail would rub their steaks with coffee grounds for added flavor. It works!

Makes. about 2 1/2 tablespoons, enough for about 6 ribeye steaks

Takes. about 2 minutes

- 1 tablespoon brown sugar
- 1 tablespoon ground coffee
- 1/4 teaspoon ground cinnamon
- 1 teaspoon crushed black peppercorns

Method

Stir it up. Mix all the ingredients together in a bowl.

BEEF BUTTER

*H*ere's is a simple compound butter that we use to top steaks occasionally. It is a mixture of butter and herbs, but it is a concept that has infinite variables. Add chipotle, ancho, brown spices, dried mushrooms, port wine, cheese, miso, or curry. Use the technique to mix butter with honey for slathering on English muffins or finishing grilled carrots or use the butter to top vegetables, potatoes, waffles, meats, and more. Let your imagination loose!

Makes. 4 ounces (1 stick) butter

Takes. 20 minutes

- 8 tablespoons (1 stick) unsalted butter
- 1/2 teaspoon chopped fresh rosemary
- 1/2 teaspoon chopped fresh parsley
- 1/2 teaspoon chopped fresh tarragon
- 1/4 teaspoon Morton Coarse Kosher Salt

Method

1| Prep. Leave the butter out at room temperature for about 20 minutes, or until it is easy to spread, or microwave in short blasts of 5 seconds at a time until it is softened but not melted. Put it in a bowl and add in the other ingredients. Mix well with a fork.

2| Shape. Scoop the mixture out onto a 12-inch sheet of plastic wrap or waxed paper, and roll it up like a Tootsie Roll, about 1 inch diameter in the middle, and twist the ends.

3| Chill. Refrigerate for several hours until firm. It can be stored in the fridge or freezer.

4| How to use it. When your steak is done cooking, while still hot, cut off a 1/4-inch slice and plop it on top, serve, and let it melt.

BOARD SAUCES



Adam Perry Lang, the great L.A. chef, has worked in such hallowed kitchens as Le Cirque and Daniel in NYC, as well as Restaurant Guy Savoy in France. He is also a first rate barbecue cook, competing on the circuit often, even winning the pork shoulder category at the big one, the American Royal Invitational in Kansas City.



In 2012 he published an excellent book, *Charred & Scruffed*. In it he describes a technique we have fallen in love with: "Board dressings" or "board sauces".

This is a really clever idea that works superbly on beef, lamb, chicken, shrimp, lobster, and who knows what else. Nothing

salvages an overcooked steak like a board sauce.

Here's how the concept works. Lang takes a handful of fresh herbs and chops them on a cutting board. Then he pours some olive oil on the herbs, minces them together, lays hot grilled meat on top of the mixture, carves the meat, and tosses the cut meat in with the board sauce, which is enriched by the meat juices. The board sauce keeps the meat moist, and brings interesting flavors to the insides of the meat. Surprisingly, shockingly, the herbs do not overpower the meat. Board sauces do not mask the meat.

We often chop the herbs while the meat is cooking and put them in a coffee cup. Then we pour in enough oil to cover them so the oil has a chance to extract more flavor from the herbs. But you cannot make it up hours in advance because the anaerobic (oxygen free) environment in the oil is friendly to the botulism microbe. Even in the fridge. If you make it in a cup you can serve a whole steak to each guest and just spoon some sauce on top.

Here's our recipe for a nice board sauce. This is by no means a fixed recipe. Riff on it! Use the herbs and spices you like best, but lean heavily on fresh herbs. Board sauces work well with flank steak, ribeye, skirt steak, strip steaks, and other beef cuts.

Makes. 2 servings

Takes. 30 minutes

- 2 pounds meat
- 6 tablespoons high quality extra virgin olive oil

- 5 large fresh sage leaves
- 2 tablespoons fresh thyme leaves, stripped from the stems
- 1 clove of garlic
- 1/2 fresh red jalapeño
- 1/4 teaspoon coarsely ground black pepper

Optional. You can use many other fresh herbs such as tarragon, oregano, bay leaf, parsley, cilantro, basil, mint. I am especially fond of black garlic.

Optional. A reader named "Joseph" says he likes to add smoked paprika which gives it a nice orange glow and sparks curiosity in his guests.

Method

1| Prep. Salt the meat about 1 hour before cooking and put it in the fridge. Called dry brining, the salt can diffuse deep down into the muscle so you get salt into the meat, not just on top of the meat. It also alters the protein so it can hold onto moisture longer.

Before the meat goes on the grill, coarsely chop the sage, thyme, garlic, jalapeño, and black pepper, and put it in a coffee cup. Mince or press the garlic and dump it in. Drizzle the oil on the pile and let it sit while you cook so the oil can draw out some of the flavor.

2| Fire up. Prepare a grill for 2-zone cooking by placing pre-heated charcoal briquets on one side of the grill's charcoal grate in order to create direct and indirect cooking zones. You

want one side scorching hot (a.k.a. warp 10) and the other side at about 225°F/107.2°C. Add 2 to 3 chunks of your favorite smoking wood to the charcoal for flavor. On a gas grill, adjust the knobs so that one side is as hot as possible and the other side is about 225°F/107.2°C.

3| Cook. Grill the steaks until dark on the outside and medium rare in the center. Try not to go beyond 130°F in the center of the steaks so there are juices running when you cut the meat. For steaks under 1-inch thick, place them on the direct heat side of the grill with the lid open, turning frequently until they reach an internal temperature of 130°F/54.4°C. For thicker steaks, place them on the indirect side with the lid down until they hit about 120°F/48.9°C, and then move them to the hot side to sear them, flipping frequently until a nice brown crust has formed and they have reached an internal temperature of 130°F/54.4°C. This is called the reverse sear and it produces the most even colored interiors.

4| Pour. When the steaks are almost ready, pour the herb and oil mix onto the cutting board. Make sure it is level or it will spill over onto the table. A board with routed out channels is best to hold it all in.

5| Serve. Place the steaks on the oiled herbs and coat both sides. Do not let the meat rest to reabsorb the juices, start cutting immediately. Let the juices run! Cut slices of tender meats about 1/2"/12.7 mm thick across the grain, and tougher meats like flank steak, about 1/8"/3.2 mm across the grain. Roll the meat in the board dressing so everybody gets a light coat just before serving.

CHIMICHURRI SAUCE



There are numerous variations on this simple, classic, no-cook green sauce for beef from Argentina, but the foundation is usually the same: olive oil, garlic, fresh parsley, and salt. This version, created by Chef Ryan Udvett, our former test kitchen director, adds brightness and lift to the rich flavors of beef. Use it on darkly seared flank steak, tri-tip, and beef subs. It even works on smoked brisket. Grill the meat and spoon a small amount of sauce over the top or

on the side when you serve it. Not too much—it is strong, and we don't want to cover that great steak taste. People can always add more if they want.

Makes. enough for 8 to 12 servings of steak

Takes. 20 minutes

- 1/2 cup olive oil
- 1/3 cup distilled white vinegar
- 1 cup finely chopped fresh flat-leaf parsley leaves
- 1 cup finely chopped fresh cilantro leaves
- 1/4 teaspoon Morton Coarse Kosher Salt
- 1/4 teaspoon freshly ground black pepper
- 3 garlic cloves, minced or pressed
- 2 dried chiles de árbol

Method

Blend. Combine all the ingredients in a food processor or blender. Pulse until the green parts are small bits, scraping down the bowl as needed. You don't have to make this sauce homogeneous. Chunks are OK. Use the sauce right away or store it in the refrigerator for a day or two. Its bright green color will fade slightly, but the goodness will remain. To preserve the color, stir in the vinegar just before serving.

HORSERADISH CREAM SAUCE



*H*orseradish puts a real giddyup in dishes like roast beef sandwiches, smoked salmon, and baked potatoes. You can also use it on **corned beef and cabbage** and its cousin, New England Boiled Dinner. Try it on **Baltimore Pit Beef**. I love it as a dip for carrots, celery, and potato chips.

Horseradish, has nothing to do with horses, happily, but it puts a real kick in other dishes. It is a white root that looks like a crooked white carrot and has lovely white flowers in

spring that smell like, you guessed it, horseradish! Farmers dig it up, clean off the dirt, peel it, and grate it. It has a kick when raw, and my wife's Uncle Carmen, whose family is from Southern Italy, was known to grate it raw on pasta with tomato sauce instead of using hot pepper flakes. It is not at full strength raw, but mix it with a little distilled white vinegar and a pinch of salt and you have the same sinus opening stuff that you can find in the chill chest of the grocery store, all three alarms ringing.

Makes. 8 sandwich servings

Takes. 5 minutes

- 1/4 cup sour cream
- 2 tablespoons prepared horseradish in vinegar
- 2 tablespoon milk
- 1 tablespoon mayonnaise
- 1/4 teaspoon **Morton Coarse Kosher Salt**
- 2 pinches ground white pepper

About the horseradish. If you grow your own, dig out a root or three, wash it well, peel it, grate it fine with a box grater, and mix in distilled white vinegar enough to make it slushy. Add a pinch or three of salt, and let it age in the fridge for a few hours to activate all the flavors.

About the sour cream. You can substitute creme fraiche, heavy cream, or mayo for part of the sour cream.

About the salt. Remember, kosher salt is half the concentration of table salt so if you use table salt, use half as much. **[Click here](#)** to

read more about salt and how it works.

About the white pepper. The sauce looks prettier without black flecks, so that's why I recommend white pepper, but if you don't have it, black pepper works great.

Optional mix-ins. Roast garlic. For serving with fish, add 2 tablespoons chopped fresh dill. For serving with beef add 4 tablespoons chopped chives or green onions.

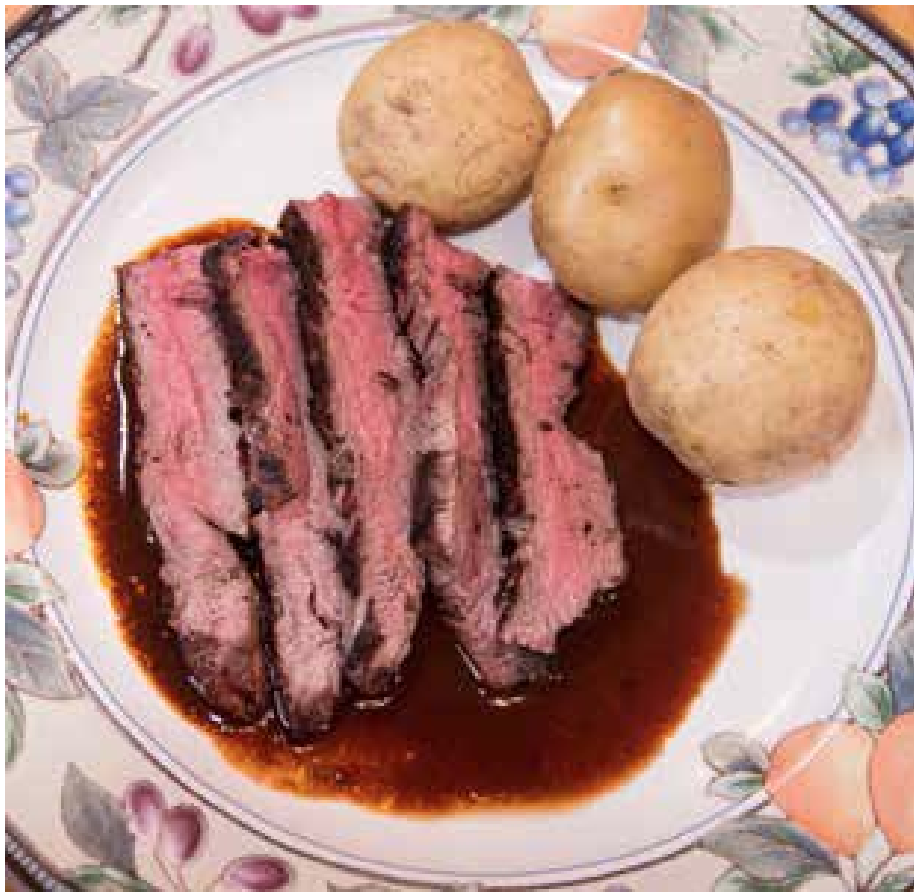
Method

1| Prep. If you have raw horseradish root, wash it thoroughly and with a peeler, scrape it until only milky white shows. Then grate it fine or beat the heck out of it in a processor or blender. Add just enough distilled white vinegar to make it slushy and spreadable, and then a pinch of salt to taste. I've tried it with other vinegars and the results are very good, but not as versatile. Let it age a few hours to reach a full gallop.

2| Mix all the ingredients and taste. Add more of whatever you want. Try to refrigerate for at least 30 minutes to allow them to mingle properly.

3| Serve. Enjoy the horseradish cream sauce with steaks, smoked salmon, roast beef sandwiches, and so much more.

RED WINE SAUCE



*T*ry this sauce and you will understand why the French are masters of cuisine. Similar to the classic French Bordelaise sauce, this velvety rich sauce makes a

classic topping for beef and lamb. I love it on beef tenderloin and filet mignon, which, although they are beloved by many, often have a metallic or liver undertone. The sauce really illuminates a lightly smoked pork chop. As heretical as it may seem, it is great on pulled pork. I like to serve boiled baby potatoes on the side, and I douse them with this sauce too.

Makes. 1 cup, enough for 4-6 servings of meat

Takes. 2 hours

- 1 carrot
- 1 large onion
- 1 stalk celery
- 2 cloves garlic
- 5 tablespoons unsalted butter
- 1 teaspoon dried rosemary leaves
- 1 teaspoon dried sage leaves, crushed
- 1 whole bay leaf
- 1 teaspoon whole black peppercorns
- 2 tablespoons tomato paste
- 1 bottle dry red wine (750 ml bottle)
- 2 cups beef stock (or a 14 ounce can)
- 1 teaspoon grape jelly
- 2 pinches of Morton Coarse Kosher Salt

About the butter. Yes, there's a lot, but don't use margarine and don't leave any out. Butter is better. There is something special about the chemistry of butter that helps enrich and thicken this sauce. That's why we don't use flour or corn starch to thicken it.

About the wine. Look for a wine that is not high in tannin. That's the component of young reds, especially Cabernet Sauvignon, that makes your tongue feel as though you've been licking a dusty window sill. Also, try for a wine that is low in acid. That's the component that makes the wine very tart, typical of Pinot Noir and Beaujolais. Steer away from the cheap jug wines that often have preservatives and rubbery flavors. Merlot is a good choice, as is Australian Syrah. You can even use a ruby port, but if you do, skip the jelly because the wine is sweet. I've even had good luck with wine from the closeout bin. You don't need to spend more than \$10 per 750 ml bottle.

About the tomato paste. There's just a little bit in this recipe, but don't hesitate to open a can. You can freeze the rest. I scoop the leftover into 1 tablespoon dollops, freeze them on a sheet pan, and then dump them into a zipper bag in the freezer. Then, whenever I need a little bit of paste, it's right there in pre-measured amounts. If you don't have tomato paste, in this recipe you can substitute ketchup.

About the beef stock. You can skip the beef stock and use 3 tablespoons of demi-glace, which is essentially a veal stock heavily reduced, and just add it with the wine. There will be less liquid then and reducing the sauce will take less time. Click here for [more on sauces, stocks, broths, etc.](#)

About the jelly. The French recipe calls for red currant jelly, and purists will lapse into apoplexy when they see the use of Concord grape jelly, but it does a great job of rounding out the middle and adding complexity. Concord grape jelly is my first choice because it is so bright and fruity, but you can use other dark fruits like

cherry or raspberry (seedless, please). In a pinch, you can use sugar, just use 1/2 the quantity of jelly.

Optional. Taste and add a dash of balsamic vinegar and splash hot sauce just for the fun of it.



Method

1| Prep. Peel the carrot, and chop it along with the onion, and celery. Crush or press the garlic.

2| Cook. In a large frying pan melt 3 of the 5 tablespoons of the butter and add the onion, carrot, celery, rosemary, sage, bay leaf, and peppercorns. Cook over a high heat, stirring occasionally, for about 15 minutes or until the onions begin to brown. That's why we use a non-stick pan, when you reduce liquid this much, it can really make a mess of other pans. By the way, the mix of 2 parts onion, to 1 part carrot, and 1 part celery is called a *mirepoix* (MEER-a-pwah), and is a foundation of French cooking and is common in soups, stuffings, and, of course, sauces.

3| Add the garlic and cook for about 2 minutes. Add the tomato paste and cook for about 3 minutes until it begins to darken. Add the wine and the beef stock. Boil for 30 minutes. Pour everything through a strainer into a saucepan, and squeeze the juices through the strainer with a ladle or whatever you used to stir the veggies.

4| Reduce. Boil over high heat until the liquid is reduced to about 1 cup (236.6 ml) and keep an eye on things so they don't burn. Add the grape jelly and stir until it is thoroughly dissolved. Turn off the heat, taste and add salt if necessary. It will not be thick and goopy like ketchup. It will be more like egg nog in thickness.

5| Use or store. If you are not planning on using the sauce immediately, you can store it in the fridge or freezer. When you need the sauce, warm it and add the remaining 2 tablespoons of butter, and when it is thoroughly melted, swirl it around with a spoon and serve immediately. Do not whisk in the butter, just swirl it. This is called "mounting it" with butter (yes, that's the correct technical term). If you feel decadent, add another tablespoon.

6| Serve. Top steaks and more with this rich red wine sauce and serve immediately.

SKIRT STEAK AND OTHER SKINNY STEAKS



*R*everse sear works best on thicker cuts. For thin steaks and ultrathin steaks like skirt steak, you need a very different technique. As with thick steaks, the goal is the same: a dark brown exterior and a tender, juicy, medium-rare interior. For steaks 1 inch thick or less, the secret is to use very high heat and keep them moving.

Makes. 2 servings

Takes. 10 minutes

- 2 steaks, each about 3/4 inch thick
- Morton Coarse Kosher Salt (about 1/2 teaspoon per pound)
- Freshly ground black pepper
- Vegetable oil

Method

1| Prep. Trim the surface fat and silverskin from the steaks if necessary. Sprinkle with salt, and dry brine in the refrigerator for 1 to 2 hours before cooking.

2| Pat dry. Just before you cook it, pat the meat dry with paper towels (moisture creates steam and prevents browning). Sprinkle with pepper and press it in with your hands.



3| Fire up. Get your grill screaming hot. If you are using charcoal, pile the coals just beneath the cooking surface as in

the picture at the top of the opposite page. On a gas grill, drop the grate as close to the burners as possible. Leave the lid off. You won't really be using the indirect zone, but it is nice to have in case you need a safe zone away from the flames.



Skirt steak

4| Cook. Put the meat over the hottest part of the grill. You need to stand by the grill and flip every minute so the hot surface cools, inhibiting heat buildup and preventing the interior from overcooking. Aim for a uniform dark brown without grill marks and 125 to 130°F in the middle. Things move fast, so be on your toes. You are a human rotisserie. Be the rotisserie.

5| Optional: The afterburner method. [We describe this method in detail above](#), but here's the cheat sheet. If you have only two skinny steaks, try it: Fire up half a chimney of charcoal. When it is at peak heat, after about 15 minutes, the

surface will be well over 1,000°F. Put a grate on top and cook the steak there. Flip every 30 seconds.



THICK STEAKHOUSE STEAKS



*T*his recipe pulls together everything described in this book, particularly the reverse sear cooking method. This is your master plan for grilling a big steak to rival

anything you'd find at a prime steakhouse. Just be sure to start with the best-quality meat you can afford. We like ribeyes, so that's what's called for here, but if you prefer porterhouse, T-bone, or another thick cut, have at it.

Makes. 2 to 4 servings

Takes. 2 hours to dry brine and about 45 minutes to cook

- 2 ribeye steaks, each about 1 1/2 inches thick
- Morton Coarse Kosher Salt (about 1/2 teaspoon per pound)
- [Mrs. O'Leary's Cow Crust](#)

Optional. If you'd rather not make this rub from scratch you can click this link and buy [Meathead's Amazing Smoked Red Meat Seasoning & Dry Brine](#) instead. Keep in mind that our bottled rubs have salt in them. When using the bottled rub with this recipe, you do not need to add the salt that is called for in the recipe.

Method

1| Prep. Trim most of the external fat from the steaks. Melting fat can cause flare-ups that deposit soot on the meat and burn the surface. Sprinkle with salt and dry brine in the refrigerator 1 to 2 hours before cooking. Add the Cow Crust. You can do this anytime. There's no need to take the meat out of the fridge early and let it come to room temperature.

2| Fire up. Set up the grill for two-zone cooking and shoot for about 225°F in the indirect zone.

3| Cook. Put the meat on the grill in the indirect zone. After about 15 minutes, start checking the interior temperature with a rapid read thermometer. Check every 5 to 10 minutes in more than one location. At this low temperature, the exterior color should not go much beyond tan; if you add wood, it might get a ruddy glow. Flip it if one side is cooking faster than another.

4| Open the lid. After about 30 minutes, the temperature in the deepest part of the meat will probably hit 110°F. Open the lid and leave it open.

5| Prepare to sear. Now that the interior is getting close to target, you will sear it to get the entire surface dark. But first you have to prep your cooker.



On a charcoal grill: Bunch the coals together or add new fully lit hot coals so you have a pile of concentrated energy. If necessary, you can take the meat off the grill to add more coals and wait for them to get hot.

On a kamado: Remove the deflector plate or move it to the direct side if you have a Divide & Conquer system that splits the deflector (right). Open the lower vent all the way and get the coals good and hot. Use a hair dryer aimed at the bottom vent to stoke the fire if needed. Lower the cooking grate as close to the coals as possible.

On a gas grill: If you have a sear burner, heat it up. If not, remove the meat and set it aside on a plate for a few minutes

while you get the grill ready to sear. You might be able to remove the grates and lower them to sit right on top of the flavor bars or deflectors that protect the burners. The closer you get to the heat source, the better. Close the lid and turn all burners on high.

On a pellet smoker: Since most pellet smokers are all indirect heat all the time, you will need to preheat a heavy pan, perhaps cast iron. Take the meat off, crank up the heat all the way, and put your heavy pan on the grill and get it rip snortin' hot. Or place the meat right on top of a clean heat deflector.

6| Sear that puppy. Pat the meat dry and put it on the hottest part of the grill, as close to the heat source as possible. Sometimes I paint the meat with melted fat from aged beef, called "beef Love by Chef Rick Gresh." That adds a layer of complexity. Keep the lid open and turn the meat often. All our effort is on one surface at a time. Stand by your grill! Things will move quickly because the meat's surface is already hot and you need to be ready to react. If you have charcoal about 1 inch below the meat, each side can be done in as little as 3 minutes. You want the surface evenly dark, with no grill marks. If a little of the edge fat blackens, that's OK, but don't blacken the muscle fibers. There may be flareups. Try to keep the meat away from direct flame.

7| Don't overcook. When the meat hits 130°F (or your favorite temperature), get it off the flame and to the table while it is still sizzling! Err on the side of undercooking, since it will continue to carryover cook and you can always put a steak back on the grill.

8| Serve. Don't let the meat rest and cool off and lose its crust. Some prime steakhouses, like Peter Luger in Brooklyn, slice it across the grain, and then reassemble the whole thing on the platter, as shown below. This is also a nice approach if you have huge steaks that are too big for one to a person, but the juices will soften the crust.

CRUSTY GRILLED FLANK STEAK



Our two favorite steaks: Expensive ribeyes and inexpensive flank steaks. Because we're cheap SOB's, we cook flank steak a lot more than we cook ribeye.

Ribeyes are expensive because they are very tender and because they are usually marbled with thin threads of fat which adds to the texture and flavor.

Flank steaks, sometimes called London Broil steaks, are cheaper because they have very little fat, and they can be chewy if you overcook them or cut them improperly. We should point out that flank steaks used to be even cheaper than they are today, but more and more folks are discovering how good they are if they are cooked properly.

Because it is are thin, we're going to grill this baby hot and fast over direct heat, over charcoal or the sear zone of a gas grill, but we will still set up 2-zones so you have a safe zone in case the outside starts to get too dark before the center is finished. You can also use the safe zone for grilling the thin part of the steak. This is a great cut for a board sauce.

Makes. 8-12 servings

Takes. 10 minutes prep, 10-15 minutes cooking

- 4 pounds flank steak
- 1/2 tablespoon vegetable oil
- 1 teaspoon Morton Coarse Kosher Salt
- Mrs. O'Leary's Cow Crust *

** **Optional.** If you'd rather not make this rub from scratch you can click this link and buy Meathead's Amazing Smoked Red Meat Seasoning & Dry Brine instead. Keep in mind that our bottled rubs have salt in them. When using the bottled rub with this recipe, you do not need to add the salt that is called for in the recipe.*

Sauces. Make a board sauce or chimichurri sauce if you like. We like them a lot with this cut, although if you cook it properly, it is mighty fine with just salt and pepper.

Cook extra. Leftovers make great cold steak sandwiches, but we love to toss thin cold slices on top of a fresh green salad with leftover grilled asparagus, zucchini, and peppers (at right). Top it with croutons and blue cheese dressing.

Method

1| Salt the meat. An hour or two before cooking, moisten the surface of the meat, salt it, and place it in the fridge. This technique is called a dry brine and it does a great job of amplifying flavor because the salt is sucked down deep into the meat. Add the rub anytime before cooking.

2| Fire up. Start a 2-zone fire and get the hot zone as hot as possible. Flank steak is best over charcoal or the sear burner of a gas grill. If you are using charcoal, here's a trick: Raise the coals so they are about 2 inches below the cooking grate. On a Weber Kettle, put a couple of bricks under the charcoal grate as shown here. We want high heat so we can take the surface to dark brown and crusty, almost but not quite charred.

3| Trim. Flank steak is usually wedge shaped. One end is a lot thicker than the other. When you cook it hot and fast one side is either overcooked or undercooked. So here's how to outsmart the steak. If your steak is more than 1/4 inch thicker at one end than the other, cut it in half and start the thick half first. If the skinny section finishes too fast you can move it to the indirect zone. This is important: Make a mental note of which way the grain of the fibers is running. You can even put a toothpick in there as a pointer.

4| Cook. Lightly coat the meat with oil to help darken the surface and keep it from sticking. Put the thick half on first, about 2 minutes ahead of the thin half. Leave the lid off. Cook about 4 minutes on the first side or until it gets dark brown and from the side you can see the color has changed about 1/4 inch up the side. Cook on the other side about 3 minutes. The exact time will depend on your grill. We like ours rare to medium rare, at about 125°F, which is where it is when the juices start to come through the surface. Use an instant read meat thermometer to be sure you get it right. Wear an oven mitt and push it most of the way through and slowly back it out and read the lowest temp. The second side may not be as dark as the first side, but that's OK.

5| Carve. The way you carve the meat is crucial to making it easy to chew. Flank steak tends to be tough, but if you cut it thin and across the grain, it is easier to chew. [Click here to learn more about the proper way to carve flank steak.](#) Place the meat on a cutting board. Hold a thin blade at a 45 degree angle and cut 1/8 inch slices across the grain. If you slice with the grain it will be much too chewy. On a flank steak, the first cut will be a little overcooked. Not to worry, the center cuts will be just fine.



6| Fan it out. Serve the meat laid out in a fan. We usually serve it nekkid, but occasionally we spoon a small amount of [Chimichurri Sauce](#) or [Board Sauce](#) over the top. Not too much, it is strong, and we don't want to cover that great steak taste.

7| WAIT!!! OK, now that we've said this is the best recipe for flank steak, [watch this](#) video.



STEAK SOUS VIDE QUE



*W*e often lie awake at night dreaming of the perfect steak, an intoxicating mouthful of flavor with every bite. Tender as a love ballad, juicy as a Georgia peach, with a crisp crust that deftly balances smoke and seasoning to create a steak that puts even the finest steakhouse to shame. Sous vide que to the rescue.

By following the sous vide, rapid chill, smoke, and reverse sear method, you may just make the best ribeye you ever tasted. Try this and then make your sous vide machine earn out its purchase price and cook a tougher cut like flank steak, London broil, merlot steak, hanger steak, or anything from the rump.

If you are not familiar with sous vide, [read this](#), or consider buying [our Deep Dive Guide on the subject](#).

Makes. 2 steaks, 2 to 4 servings

Takes. 2 hours to sous vide, 1 hour to chill, approximately 20 minutes to smoke and sear

- 1 (1.5" thick) ribeye steak
- Morton Coarse Kosher Salt
- [Mrs. O'Leary's Cow Crust](#)

Optional. If you'd rather not make this rub from scratch you can click this link and buy [Meathead's Amazing Smoked Red Meat Seasoning & Dry Brine](#) instead. Keep in mind that our bottled rubs have salt in them. When using the bottled rub with this recipe, you do not need to add the salt that is called for in the recipe.



Method

1| Prepare a sous vide immersion circulator and set the water temperature for 131°F.



2| **Season** the steak with about $\frac{1}{2}$ teaspoon of Morton Coarse Kosher Salt per pound of meat. Seal it in a sous vide bag and if you can, let it dry brine for an hour or two.

3| **SV.** Sous vide for 2 hours.

4| **Chill.** Prior to the end of the sous vide process, fill a large container with a 50/50 mix of ice and water. Once the steak is finished cooking, still in the bag, place it in the ice water for 30 to 60 minutes to quickly lower the meat's core temperature. Place the steaks in the refrigerator until ready to grill (up to a week ahead of time).

5| **Fire up.** Prepare a grill for **2-zone cooking**. On a charcoal grill, place a chimney full of pre-heated charcoal briquets to one side of the grill. You want one side scorching hot and the other side at about 225°F. Add 2 to 3 chunks of your favorite smoking wood to the charcoal for smoke flavor. On a gas grill, adjust the temperature knobs so that one half of the

grill is as hot as possible, Warp 10, and the other half is approximately 225°F.

6| Reheat. Once the grill is ready, remove the chilled steak from the bag, pat it dry, sprinkle on the Cow Crust, and place it on the indirect convection heat side of the grill as far away from the heat source as possible. Place the lid on the grill with the top vent fully opened and positioned directly above the steak in order to force the smoke over and around the meat. Allow the steak to smoke until it reaches an internal temperature of about 115°F on **a good digital thermometer.**

7| Sear. Remove the lid, move the steak directly above the heat source on the direct IR side as close as you can get it to the heat source and sear the steaks while frequently flipping until an even dark crust has formed. At this point, the internal temperature of the steaks should be in the medium rare range, 130 to 135°F. It is best to aim for the lower temperature in order to avoid possible overcooking during carryover.

MORE STEAK RECIPES

We wanted to give you a taste of different steaks in this book, but there are so many more things one can do. Here are a few more of our growing list of steak recipes, all available on AmazingRibs.com:



Sous-Vide-Que Ribeye Steaks: Made Ahead Then Seared Last Minute



Grilled Drunk Chuck Steak



Caprese Flank Steak Takes The Classic Italian Salad To The Grill



Try This Grilled Filet Mignon Eggs Benedict For A Very Special Breakfast



Poaching A Bison Ribeye Steak In Butter Then Grilling It Works Magic



Elk Steak Seared In Cast Iron Is as Simple And Delicious As It Gets

SIDE DISHES

*A*fter all your careful prep and cooking, let the steak be the center of the show. One or two sides are all you need, especially if you've already got sauce on the meat. Meat and potatoes are an unbeatable combo, although rice is nice and couscous is cool. Try our really simple [Warm French Potato Salad](#). Keep the veggies simple, like our [Crunchy French Green Beans](#), or, since the grill is primed and ready, go for [Grilled Asparagus](#).

For other delicious sides, check these out:

- Our [potato recipes including fried, baked, twice baked and mashed](#)
- [The Best Grilled Corn On The Cob Ever](#)
- [Potato salad recipes](#) especially [Mom's Old Fashioned Potato Salad](#)
- [Mac-and-cheese recipes](#) especially [Smoked Mac And Cheese](#)
- [Regional beans recipes](#) especially [Bourbon BBQ Baked Beans](#)

- Veggie, salad, and slaw recipes especially Creamy Southern Coleslaw and Thai-style Chilled Cucumber Salad and Caprese Tomato Salad
- Cornbread, garlic bread, and other bread recipes especially Griddle Grilled Corn Cakes
- Potato recipes especially Grilled Sweet Potato Fries and Grill Baked Potatoes
- Snacks and munchies especially Grilled Guacamole
- and soooo many other wonderful tested recipes

PART VIII

CHECK THIS OUT

Here are some goodies from AmazingRibs.com

MEATHEAD'S AMAZING SEASONINGS & DRY
BRINES

BIG. BOLD. FLAVOR



*M*any meals ago, in 2005, my neighbor challenged me to a rib cookoff. I won, got a swelled head, and built a website to share my “secrets.” Now, according to Forbes, Meathead’s AmazingRibs.com is “By far the leading

resource for BBQ and grilling information” and I am in the Barbecue Hall of Fame.

Since I founded the site in 2005 I have shared more than a dozen of our favorite rub and sauce recipes for free, like the ones on the previous pages, and they have become hugely popular. All of them have won big bucks in competitions and been used in restaurants. Finally, after 16 years, in November 2021, we listened to your requests and created three bottled rubs and a sauce under the name “Meathead’s Amazing.” They are based on our free recipes, but have several new ingredients and changes.

Why there is salt in these rubs? When you make rubs at home, we recommend you do not add salt because salt penetrates and none of the other spices and herbs do, so thick cuts need more salt. We put salt in these bottled rubs because all commercial rubs have salt and without salt the price would be outlandish. Also, without salt buyers would wonder why their food needs salt. You can still use these as a dry brine, just sprinkle the rub on well in advance to give the salt time to penetrate. For very thick cuts of meat, we recommend adding a bit more salt. [Click here to order them.](#)

BIG. BOLD. FLAVOR.

Meathead's BBQ HALL OF FAMER

<https://amazingribs.com/flavor>
Free cookbook with purchase

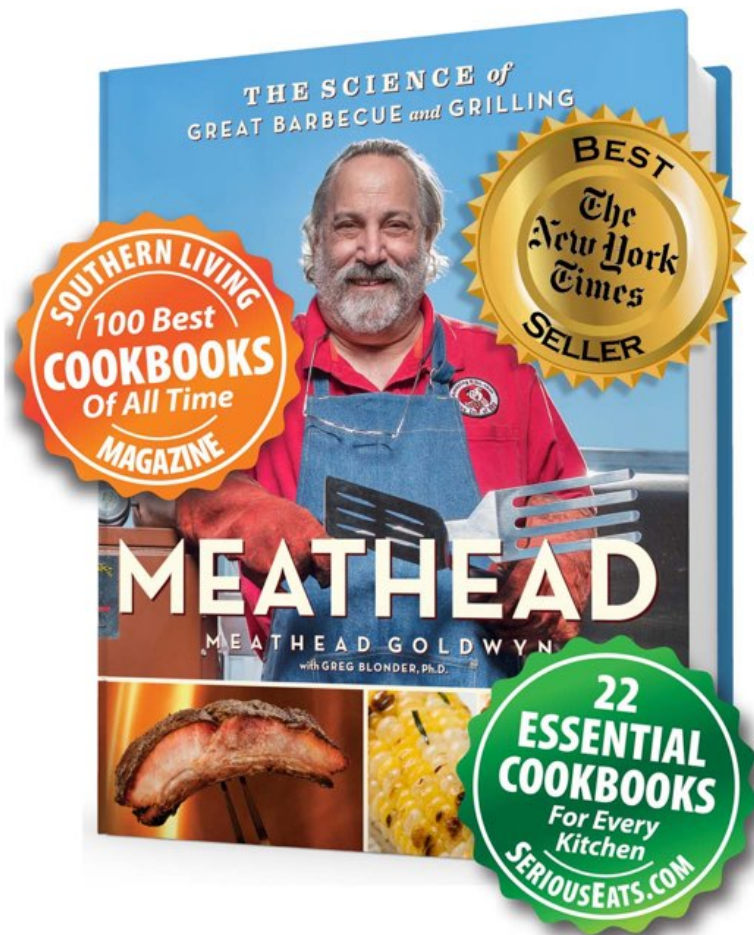
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***“By far the leading resource
for BBQ and grilling
information” Forbes***

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Meathead, The Science of Great Barbecue And Grilling
"100 Best Cookbooks Of All Time" Southern Living
New York Times Best Seller

3,047 ratings on Amazon ★★★★★



Meatheads
AMAZINGRIBS.COM FOOD TEMPERATURE GUIDE
 "By far the leading resource for BBQ and grilling information" Forbes

Meat / Item	Temperature (F/C)	Notes / USDA Minimum
Beef, Lamb, Venison, Duck Breasts (Steaks, Chops, Roasts)	110-120°F (43-49°C)	USDA Minimum 145°F (63°C)
Blue, "Pittsburgh"	120-130°F (49-54°C)	Dark purple, cool, stringy, slippery, slightly juicy
Rare	130-135°F (54-57°C)	Bright purple to red, warm, tender, juicy
CHEF TEMP Medium Rare	135-145°F (57-63°C)	Bright red, warm, tender, very juicy
Medium	145-155°F (63-68°C)	Deep pink, yielding, juicy
Medium Well	155°F (68°C) or more	Slight pink, some tan, firm, slightly fibrous, moist
Well Done	160°F (71°C) or more	Tan to brown, no pink, chewy, dry
Pork, Raw Ham, Veal (Steaks, Chops, Roasts)	145°F (63°C)	USDA Minimum 145°F (63°C)
Rare	120-130°F (49-54°C)	Pale pink center, warm, tender, slightly juicy
Medium Rare	130-135°F (54-57°C)	Creamy pink color, bouncy, very juicy
CHEF TEMP Medium	135-145°F (57-63°C)	Cream color, some pink, yielding, juicy
Medium Well	145-155°F (63-68°C)	Cream color, firm, slightly juicy
Well Done	155°F (68°C) or more	Cream color, tough, dry
Chicken, Turkey (Whole Or Ground), Including Stuffing	165°F (74°C)	USDA Minimum 165°F (74°C)
SV TEMP Medium Well	150-150°F (66-68°C)	Cream color white meat, pale tan dark meat, tender
CHEF TEMP Well Done	160°F (71°C)	Cream color white meat, pale tan dark meat, firm
Ground Meats & Raw Sausages	160°F (71°C)	USDA Minimum 160°F (71°C)
SV TEMP Medium	145°F (63°C)	Grill or pan fry these risky meats to 160°F (71°C) and make them juicy by using a 20 to 30% fat blend
Grill or pan fry these risky meats to 160°F (71°C) and make them juicy by using a 20 to 30% fat blend		
Tuna - USDA Minimum 145°F (63°C)		
CHEF TEMP Rare	120-125°F (49-52°C)	Bright reddish purple
Other Fin Fish - USDA Minimum 145°F (63°C)		
CHEF TEMP Medium Rare	125-135°F (52-57°C)	Slightly translucent, flaky, tender
Lobster, Crabs, Crawfish, Shrimp, Scallops	USDA/CHEF/SV TEMP When opaque 131°F (55°C)	
Hams, Hot Dogs, Precooked Sausages	USDA Minimum 140°F (60°C)	
CHEF & SV TEMP Warm	140°F (60°C) or more	Tender, juicy
BBQ/Roasted Ribs, Shoulders, Briskets, Legs, Rumps	USDA Minimum 145°F (63°C)	
CHEF TEMP Tender, Tugs Apart	203°F (95°C)	High in fat and collagen, best cooked low and slow
Clams, Oysters, Mussels	USDA/CHEF/SV TEMP When shells open	
Leftovers	USDA/CHEF/SV TEMP Minimum 165°F (74°C)	

SOUS VIDE (SV) RULES OF THUMB

These times and temps are starting points that will produce meats that please. Experiment!

A - TENDER CUTS

- 1 - Cook. Salt, then sous vide for 2-4 hours at the temp or left.
- 2 - Optional. Chill thoroughly in the bag.
- 3 - Rub. Remove from bag, pat dry, sprinkle generously with salt-free rub or lightly with salted rub.
- 4 - Finish. Sear in a hot pan, griddle, or on a grill until you like it, or smoke at 225°F (107°C) and then sear. Bring to the temp or left. Glaze or sauce if you wish.

B - TOUGH CUTS

- 1 - Cook. Salt, then sous vide at 145°F (63°C) for about 24 hours.
- 2 - Optional. (Chill thoroughly in the bag).
- 3 - Rub. Remove from bag, leave wet, sprinkle generously with salt-free rub or lightly with salted rub.
- 4 - Roast or smoke. Roast or smoke at 225°F (107°C) until 145-155°F (63-68°C).
- 5 - Optional. Thoroughly dry the surface. Sear in a hot pan, griddle or on a grill. Glaze or sauce if you wish.

For ratings and reviews of more than 150 accurate, inexpensive digital thermometers and 880 thermometers visit: AmazingRibs.com/thermometers

More info on Meatheads's AmazingRibs.com Version 5.0 Copyright © 2020

Order our Award Winning Food Temperature Guide. This 8.5 x 11" magnet has more than 80 benchmark temperatures for meats (USDA recommended temps as well as the temps chefs recommend), fats and oils, sugars, sous vide, freezer and fridge temps, eggs, collagens, wood combustion, breads, and more.



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