



# KITCHEN SCIENCE

REVISED EDITION

*A Guide to Knowing the Hows and Whys  
for Fun and Success in the Kitchen*

HOWARD  
HILLMAN

- Why freezing ruins the texture of meat
- Why new potatoes are best for salad
  - Why onions make you cry
  - Why baking powder leavens
- How to make perfect sauces, custards, and soufflés



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# K · I · T · C · H · E · N

*A Guide to Knowing the Hows and Whys*

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Revised Edition

*Illustrations by Jill Kampmier*

BOSTON

# S · C · I · E · N · C · E

*for Fun and Success in the Kitchen*

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HOWARD HILLMAN

COAUTHORS Lisa Loring  
Kyle MacDonald

HOUGHTON MIFFLIN COMPANY

## DEDICATION

*To creative, intellectually curious cooks  
because they make cooking and dining  
more fun, and more exciting and delicious.*

## *Foreword to the Revised Edition*

By popular demand, we've expanded *Kitchen Science*, by 25 percent. It was fun because we love to eat, cook, and experiment (a friend affectionately nicknamed us "mad scientists in the kitchen").

Our new book is a substantive update. We wrote a new chapter. And we added at least several new Q&A's to each existing chapter — and revised many of the Q&A's. Overall, we've added more than one hundred new Q&A's and revamped over seventy-five existing ones.

We selected the new questions based mainly on the suggestions we received from you, our readers. We listened. For example, we've added many new Q&A's on diet, health, and nutrition because many of you have a growing interest in those topics.

My staff and I hope you will enjoy the new *Kitchen Science* as much as you did the original one.

HOWARD HILLMAN



## *Preface*

An ancient Chinese philosopher once advised his assembled followers,

Give a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime.

There is a parallel in cooking:

Find yourself a recipe, and you can cook one dish. Teach yourself the science of cooking, and you can cook creatively forever.

Creative cooking requires love, imagination, art, and science. The love and imagination can be encouraged but not taught, the art is acquired from experience and through helpful guidance from other cooks, and many of the practical scientific principles can be learned from this book. As a quick thumbing through its pages will show you, *Kitchen Science* takes the mystery out of cooking, and does so in nonacademic language. You will learn why baking powder leavens, why freezing ruins the texture of meat, why some pots are superior to others, why some people can eat more hot chilis than other people, why sauces thicken, why new potatoes are best for making potato salad, why a “bloody rare” steak is not really bloody, why a soufflé rises, and hundreds of gutsy answers to other practical questions.

*Kitchen Science* will help you become a more creative cook because you will not only be better able to adapt recipes but will also need to rely less on them. When your kitchen or market lacks a specific ingredient, you will be able to improvise with greater flair. In short, you will be able to create new dishes and modify old ones more freely because you will know what can and cannot be done — and why.

The “whys” have been well researched. In addition to having devoured hundreds of weighty tomes and thousands of academic articles that explore the world of food science, my staff and I have interviewed a wide variety of food scientists and have conducted countless experiments in the kitchen in order to separate food facts from myths. Supplementing that information is my knowledge, which comes from having written other food books and from having a lifelong interest in discovering the “whys” of cooking.

I enjoyed researching and writing *Kitchen Science* because it was an exhilarating, mind-stretching experience that has further increased my own creativity in the kitchen. I hope you share my enthusiasm for kitchen science.

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# I

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## C · O · O · K · I · N · G

## E · Q · U · I · P · M · E · N · T

### **W**hy are dull knives more dangerous than sharp ones?

The sharper the knife, the less likely cooks are to cut themselves. This may sound like dull-witted reasoning, but the point is valid for two pragmatic reasons. First, people tend to be more careful when using sharper knives because the potential harm is more vivid in their minds. Second, a duller knife is more apt to slip when cutting because it requires more downward pressure to do the job.

There are more benefits from a sharp knife than just safety. It will make cutting quicker and more efficient, will minimize ripping and tearing of the food, and — when appropriate — will make thin slices.

Two of the wisest rules for any kitchen are to buy quality carbon steel (or, at least, high-carbon stainless steel) knives and to keep them well honed.

### **How do carbon and stainless steel knives differ?**

Both knives have blades of steel, an alloy consisting mainly of iron mixed with carbon and a smaller portion of other

elements. The critical difference between carbon and stainless steel alloys is that the first has a higher carbon content, whereas the other amalgamation contains more chromium, and often nickel.

The relatively new high-carbon stainless knife is betwixt and between the two — its carbon, chromium, and nickel proportions lie somewhere in between those of the standard carbon and stainless steel varieties.

Yet another variation of the theme is the superstainless knife, the one with the scintillating silvery look. Its alloy — at least its plating alloy — is impregnated with relatively large quantities of chromium and nickel.

An alloy's precise make-up determines to a considerable extent a knife's advantages and disadvantages for a cook.

### **What are the pros and cons of each knife blade alloy?**

A knife made with carbon steel is unequaled in its ability to take an extremely sharp edge, and therefore it is preferred by most serious chefs. The major drawback of carbon steel is that unless the blade is promptly wiped dry after each use, it will rust. The alloy is also vulnerable to attack by the acid in foods like citrus fruits, tomatoes, and onions. If the knife is not washed soon after contact with these ingredients, the acid will react chemically with the metal, blemishing the blade's surface with blackish stains. Moreover, that discoloration and its attendant off-odor can be transferred to the foods you are cutting.

Superstainless steel is the least efficient of the four basic knife alloys. It is all but impossible for a cook to restore its sharpness once the knife loses its original well-honed edge (if the manufacturer gave it one in the first place). Kitchenware demonstrators speak hokum when they claim that superstainless steel knives never need to be sharpened. What they should tell you is that their products can't be sharpened.

Stainless steel, like its supercousin, resists rust, stains, and corrosion caused by water and acid. Though it takes a sharper edge than a superstainless one, a stainless steel blade will still be annoyingly dull in the hands of a busy cook.

A high-carbon stainless steel knife — by far the most expensive of the four types — will neither rust nor stain. Consequently, it is the answer for a cook who lives by the sea or in a humid climate, because salt can corrode and moisture can oxidize (rust) nonstainless steel. High-carbon stainless steel is also recommended for cooks who do not want to be bothered with having to wash the knife and wipe it dry promptly after each use — or who do not want the knife and food to become tarnished because the chore was neglected.

Although a blade made from high-carbon stainless steel can be honed to a fairly sharp edge, do not believe the food writers and salespersons who tell you that its sharpness will match that of a knife made with carbon steel. As our kitchen tests verify, this is physically impossible.

### **What should I look for when buying a knife?**

Selecting the right blade alloy is not enough. You should buy only a knife produced by a quality manufacturer because fine knife making requires skilled workmanship involving a myriad of precision tasks, such as tempering the steel. In fact, unless you can buy superb carbon steel knives (they are becoming difficult to find in America nowadays), we recommend that you purchase the top-of-the-line, high-carbon stainless steel knives of a quality manufacturer, such as Wüsthof (Trident trademark) or Henckels.

The tang (the part of the metal enclosed by the handle) should run the full length of the handle and should be well secured with at least three rivets. Otherwise, the handle and the metal part of the knife may separate within a matter of years (a top-caliber knife should last a lifetime). The full tang also contributes weight and balance, two essential qualities that inexpensive knives usually lack.

A knife's handle should be easy to grasp and should feel comfortable in your hand. Its material should be durable, nonslippery, and — for your hand's sake — a poor conductor of heat. Nearly all hardwood and many modern plastic-and-wood composite grips fit the bill; plastic hilts do not.

There exist many styles of knives to choose from — some functional, some fanciful. It is wiser and more economical in the long run to invest in a few quality knives than to purchase a broader assortment of less expensive and inferior implements. Our recommended six-unit starter's set performs a wide variety of tasks. It comprises a three- to four-inch (blade length) paring knife, a six-inch utility knife, an eight-inch serrated slicing knife, an eight-inch chef's (chopping) knife, a ten-inch nonserrated slicing (carving) knife, and a ten-inch butcher's steel for honing. Of the group, the indispensable quartet consists of the butcher's steel, the paring knife, and the chef's and nonserrated slicing knives.

As the accompanying illustration shows, there is a notable difference — for reasons of function — between the cross-sectional blade of the slicing and chef's knives.

Because the first blade is relatively thin, friction and food crushing is minimized as the knife slides through the food. Just as important, the thinner design allows the carver to cut narrower and more uniform slices because the blade stays reasonably parallel to the face of the cut.

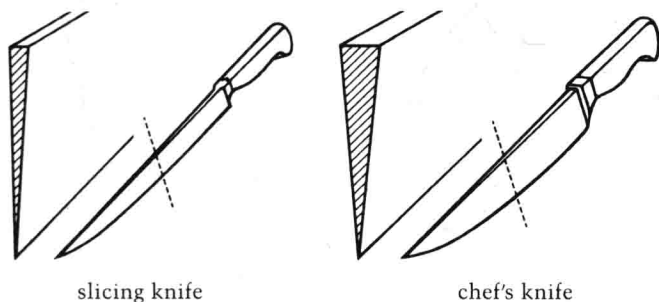
The wedge shape of the chef's knife is, by contrast, broader on the top of its cross section. That extra weight gives the blade extra momentum and therefore more power to help the cook chop through firm food.

### **What are the best and worst ways to sharpen a knife?**

Honing a knife on one of those extremely coarse grinding wheels or belts that are commonly used by peregrinating peddlers or key makers is one of the most unsatisfactory methods. Repeated sharpenings on these instruments will wear away your blade within a few years. Almost as bad are those small pairs of steel rotating disk-cylinders that are supposed to be attached to a kitchen door or cabinet. Not only do these gadgets devour the metal of the blade faster than need be, they tend to scratch the blade too much and throw it out of alignment.



### Cross-Sectional Views



The best day-to-day sharpening implement is the butcher's steel, a rough-surfaced, hard metal rod equipped with a handle. However, unless you use the steel frequently to sharpen the knife, as a butcher is wont to do, the edge of your knife may dull beyond the restorative powers of the honing rod. In that case, you will need to sharpen the knife periodically with a whetstone, a small, abrasive, bluish-black block made of the exceptionally hard silicon carbide, Carborundum (available in most hardware stores).

Some food authorities say that  $15^\circ$  is the correct honing angle, whereas other estimates place the number at  $25^\circ$  or even  $30^\circ$ . For the record, approximately  $20^\circ$  produces the best results.

### Does the cutting surface affect a knife's sharpness?

The harder a cutting surface, the more quickly a knife dulls. Hard surfaces include metal, marble, china, crockery, enamel, glass, and most kitchen countertops. The softest, and therefore the most desirable, of the popular cutting surfaces is wood. Though softwood does less harm to the knife's edge, hardwood