WHEAT BELLY COOKBOOK

150 Recipes to Help You Lose the Wheat, Lose the Weight, and Find Your Path Back to Health

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HarperCollins e-books

To everyone who has come to understand the liberation that emerges with wheatlessness.

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INTRODUCTION

The truth will set you free, but first it will piss you off.

GLORIA STEINEM

WHEAT IS NOT the "healthy whole grain" it was pretending to be. Like a faithful spouse exposed as a philanderer and polygamist, wheat is not to be trusted. Held up as an icon of health, it is in reality a major contributor to the world's worst epidemic of obesity and an astounding list of health problems, from simple annoyances like dandruff to incapacitating conditions like dementia.

This is a cataclysmic revelation for most people: It's unsettling, it's upsetting, it's downright inconvenient. The condemnation of wheat is as paradigm shifting, earth shattering, and life changing as the emergence of the Internet, the packaging of collateralized debt obligations and the collapse of mortgage markets, the upheavals of the Arab Spring … events that shook core beliefs, upended comforting habits, and changed worldviews.

Wheat is the Enron of the food world, the tobacco industry all over again—frauds, both intentional and inadvertent, conducted on an international scale. Charming and engaging on the outside, sociopathic and destructive on the inside, it works its way into your life, wreaking havoc in every conceivable health-destroying way.

These are, for those of you unfamiliar with the arguments set forth in *Wheat Belly: Lose the Wheat, Lose the Weight, and Find Your Path Back to Health* (Rodale, 2011), undoubtedly bold assertions that fly in the face of nutritional wisdom. The Dietary Guidelines for Americans issued by the USDA and the US Department of Health and Human Services, as well as the American Heart Association, the American Diabetes Association, and the Academy of Nutrition and Dietetics all agree: Healthy whole grains should make up a substantial portion of your diet.

This is colossally bad advice. "Eat more healthy whole grains" is among the biggest health blunders ever made in the history of nutritional advice. Modern health care, treating millions of people at the cost of hundreds of billions of dollars every year for hypertension, high cholesterol, obesity, arthritis, acid reflux, irritable bowel syndrome, fibromyalgia, migraine headaches, depression, diabetes, various forms of neurological impairment, and on and on, is really treating … wheat consumption. And the endlessly repeated advice to eat more "healthy whole grains" fuels this fire, much to the appreciative applause of the pharmaceutical industry. After all, the pharmaceutical industry funds a good part of the wheat lobby promoting and propagating this message. Oh, you didn't know that? Yes, a long list of drug manufacturers have close financial ties to the organizations that lobby Congress, help establish school lunch policy, and get cozy with the USDA to maintain the lofty nutritional role of "healthy whole grains."

And, yes, the clinical studies documenting these arguments have already been performed, but rarely do they make the light of day in media supported by Big Food, who count wheat products among the handful of commoditized ingredients, subsidized by the US government, that serve as the basis for most processed foods.

In health, as in software, we are living examples of the principle of *garbage in, garbage out*. Put this stuff, the creation of geneticists from the 1960s and 1970s, into your body, and you get all manner of unanticipated health effects.

Since the release of *Wheat Belly*, I have become convinced that not only is this an incredibly big issue for health, the situation is *worse* than it first appeared. It has affected far more people than I originally anticipated and to such an extraordinary degree that it is difficult to overestimate the severity of this problem. This is no fad that will flare and then burn out, much as the misguided low-fat notion has. This is *not* a dietary precept like "get more fiber." It is an exposure of the genetic and biochemical changes introduced into this common foodstuff, all in the name of increased yield-per-acre, but with no questions asked about its suitability for human consumption.

We are, in effect, experiencing the consequences of a grand agricultural experiment gone sour.

Hey, Marlboro Man: Have a Bagel!

Remember this? "According to a nationwide survey: More doctors smoke Camels than any other cigarette"? In the mid- and latter 20th century, the national discussion went from gushing about the pleasures and health benefits of smoking, to studies documenting the health damage caused by smoking, to executives denying any wrongdoing to Congress, to uncovering concealed documents demonstrating the industry's knowledge of the adverse health effects of smoking *decades* earlier.

We are reliving the tobacco experience with wheat in its place. I believe that smart food scientists stumbled on the *appetite-stimulating effect* of the gliadin protein in wheat *25 years ago*. How else do we explain why wheat is in virtually all processed foods, from tomato soup to licorice? In 1960, you would have found wheat in bread, rolls, and cakes—obvious places that make sense. Go up and down the food aisles in your local supermarket in the 21st century, and you will find that nearly *all* canned, packaged, and frozen foods contain wheat in some form. Is wheat that necessary for taste, or for texture? I don't think so. I think it's put there for one reason: to stimulate your appetite and increase sales.

The transformation of the gliadin protein in newly created strains of wheat was accompanied by an increase in calorie consumption of 440 calories per day. By putting wheat in everything, the food industry, especially Big Food, ensured that you come back for more. Just as tobacco manufacturers increased nicotine content of cigarettes to ensure addiction, so adding wheat to every processed food created addictive behavior in response to all things wheat. Eating 440 more calories per day, 365 days per year—not only does that add up to a lot of calories and a lot more food consumed, it adds up to a lot more weight. (Using a simple calories-in calculation, this yields 160,000 calories, or *45.8 pounds* gained in a year. This is an oversimplification, since calories-in, calories-out is a flawed concept, but it nonetheless illustrates how substantial this effect can be.) The introduction of the new form of gliadin was followed shortly thereafter by a nationwide increase in weight. After people gained 30, 50, 60, or more pounds, an explosive surge in diabetes followed. We are now in the midst of the worst epidemic of diabetes ever experienced by humans, such that the curve showing the number of people with diabetes is in a vertical climb straight upward, a trajectory that is likely to engulf your children

and grandchildren.

The gliadin protein of wheat ensures that wheat products, such as whole grain or white breads, bagels, and muffins, are *addictive:* They generate a need for more … and more, and more. Gliadin is an *opiate*, you will discover, with its own form of euphoria and its very own *opiate withdrawal syndrome* when wheat consumption stops that can also be provoked with opiate-blocking drugs.

So the inadvertent transformation of wheat gliadin into a much more potent appetite stimulant, recognized quickly by observant food scientists, brought us here, to this overweight, diabetic situation that now plagues Americans and much of the rest of the developed world … while we are advised to eat more "healthy whole grains." No doubt, many people profited handsomely—and continue to do so—from this message, but the public has paid the price, both with their pocketbooks and their health.

There's Power in Them Tweets

Since the release of the first *Wheat Belly*, social media has served the role of a worldwide stage for these arguments to play out.

Some things, when enacted in real life in real people, are so consistent and powerful that, despite their anecdotal nature, they serve to reinforce what we learn through scientific observation. If I hit my head with a hammer and it hurts, and my head stops hurting when I stop hitting it, do I need a double-blind, randomized clinical trial to prove that hitting my head with a hammer causes head pain? The association is so consistent and obvious that you can safely accept the premise that the hammer is the cause. Likewise, eliminating wheat has been demonstrated, through the thousands of people who have embraced these ideas, to produce life-changing transformations of health and weight that most thought were impossible, allowing them to throw away multiple medications and leave behind years of pain, wheezing, diarrhea, cramps, swelling, fatigue—within *days* of saying goodbye to their bran muffins or breakfast cereal.

In the Middle East, social media allowed the masses to organize, communicate, and overthrow despotic dictators. In no other time in history could dissent disseminate so rapidly, revolt be organized within hours. Likewise, social media is now showing us, on an unprecedented scale and abbreviated timeline, that rejecting all things wheat is among the most powerful and liberating health strategies imaginable. We purge this Muammar Gaddafi of diet using the facility and speed of Twitter, Facebook, and other electronic media, spreading the word of dietary revolution using the very same tools.

This is not a popular message at the USDA, or in the halls of Big Food and Big Agribusiness. It's not uncommon, for instance, for agribusiness giant Monsanto to spend more than $2 billion *per quarter* to lobby the federal government to influence policymakers—and that's just one company. Dollar for dollar, we cannot even begin to compete with such forces. Ah, but we can talk to each other and share our experiences, something that these dominating corporate forces are unlikely to do with us.

Lose the Wheat, Lose the Weight … and the Acid Reflux, and the Edema, and the Mental "Fog" …

Much like when you stop hitting your head with a hammer and the headache miraculously goes away, so eliminating all wheat from the diet is followed by the majority of people experiencing abrupt and substantial weight loss along with relief from a long list of health conditions.

In other words, the proof of this concept is in your own hands, a simple rearrangement of food priorities in your own pantry. You don't have to wait for a large-scale clinical trial to know whether this is relevant to your health situation. If you decide to wait for national advice to embrace this concept, you are going to wait a very, very long time. How do official agencies undo the disastrous advice of the last 40 years without losing credibility, without incurring legal liability for the unimaginable economic damages—and without losing the revenue stream that this corrupt message has generated? You don't have to wait. You can start the process and know within *days* whether this thing called wheat has been to blame for your health and weight.

The total effect experienced in eliminating wheat is greater than the sum of its parts: It's a 2 + 2 = 11 phenomenon. That's no typo. Getting rid of wheat is *that* big. Despite our knowing about many of the undesirable changes introduced by geneticists into modern wheat, the health changes—health *transformations*—experienced by most people who say goodbye to wheat are often *far greater than we'd predict*. It makes for some of the most compelling success stories in weight and health you could imagine.

Gluten-Free … and Other Blunders

A growing number of people are declaring themselves gluten free, thereby buying and consuming gluten-free foods.

Big mistake. Yes, it's a very good thing to avoid the gluten from wheat. But this can take you down the path of gluten-free processed foods. Oddly, the majority of manufacturers of gluten-free foods have chosen to base their products—with rare exceptions—on rice starch, cornstarch, potato starch, and tapioca starch. While they may provide a reasonable facsimile of gluten-containing wheat flour–based products in taste and texture, they are among the few foods that raise blood sugar *even higher* than the high levels generated by wheat products. In other words, gluten-free multigrain bread or gluten-free pasta, from the perspective of high levels of blood sugar and its consequences, are poor choices as replacements for wheat.

So we should be *wheat* free and *gluten* free, but also *free of gluten-free foods* made with junk carbohydrates.

A bit confusing, yes. This was part of my motivation for adding the *Wheat Belly Cookbook* to the discussion, to help you re-create delicious foods without wheat and without the rice starch, cornstarch, potato starch, and tapioca starch of commercial gluten-free foods. The recipes presented herein are tasty, don't screw with blood sugar, don't trigger appetite, and are truly healthy—a novel concept!

Lettuce and Cardboard?

For many people, the prospect of giving up wheat is daunting, even downright terrifying, especially since wheat comes with its very own withdrawal syndrome. Not only might you be deprived of something that yields an addictive relationship, but what foods will remain? Will you starve? Will you have to live on lettuce, cardboard, and tasteless replacement foods?

Not at all. As many wheat-free people will attest, foods minus wheat are actually *more* enjoyable. A fundamental change occurs when you remove this addictive food: You enjoy food for its own sake, not because there is an appetite stimulant present making you eat anything you can get your hands on. Taste is heightened: You are better able to discern the nuances of foods, but also more sensitive to sweetness, with formerly tasty treats now sickeningly sweet. You are less hungry to the tune of 440 fewer calories per day; what you eat, you enjoy *more* since you are having *less*.

Foods can be wonderfully varied without wheat. In addition to beef burgundy and pizza, you can have muffins, cookies, pies, scones, and other former wheat-containing foods, made using truly healthy ingredients. These are among the 150 recipes in the *Wheat Belly Cookbook*.

What this is *not* is a gluten-free cookbook. No food manufacturer or author of a gluten-free cookbook I know of yet understands the principles of healthy wheat-free, gluten-free eating sufficiently to craft truly healthy gluten-free food. If you want to get fat and diabetic, develop cataracts and arthritis, and grow a belly full of inflammatory visceral fat, eat gluten-free substitutes sold in stores or follow the recipes in the newest gluten-free cookbook. So the recipes I've developed here are indeed free of wheat and gluten, limited in carbohydrate exposure—and truly healthy.

Quit Your Bellyaching!

"Don't you miss it?" and "Aren't you tempted to eat a doughnut?" are among the common questions from those contemplating a life sans wheat.

If, by the end of these opening chapters, you aren't eyeing your beloved multigrain bread or onion ciabatta with suspicion or outright horror, then I haven't done my job. I see my role as exposing these arguments to the light of day for all to see, not just the tarted-up, hunky-dory version presented to us by those who profit from influencing the message. My hope is that, by the time you have finished reading the first few chapters, you will understand that not only is this creation of genetics research awful for weight and health, it is downright deadly. Removing it is … liberating. It's the rainbow after the storm, remission after cancer treatment, viewing bright colors after a lifetime of blindness.

Be sure to read the success stories that I've peppered throughout the recipe section detailing many of the compelling tales of health and weight turnarounds that have come my way ever since this message has gained an international audience. Read real stories of dramatic weight loss, relief from crippling health conditions, transformations of children's behaviors—all from people denying themselves the effects of this creation of modern genetics research called wheat.

PART 1

HEALTH, WEIGHT, AND LIFE THE WHEAT BELLY WAY

Let's begin by surveying the wheat landscape. We find that it is no longer a field of beautiful "amber waves of grain," but a field of something different. It is also a battleground of obesity, diabetes, and legions of people who have succumbed to its effects.

We begin the discussion on modern wheat in three parts.

FRANKENGRAIN

Agricultural scientists have stitched the genetics of this thing together, concocted from extensive, sometimes bizarre experiments to increase yield-per-acre of wheat.

How has it changed? Just as the Frankenstein monster, the creature created with body parts woven together in a laboratory, terrorized the countryside, so this Frankengrain has worked its way onto your kitchen table, doing its dirty deeds on your health. This gets a bit complicated, but you will discover that the deeper we dig, the worse it gets. You will gain an understanding of just how far off course this thing has been taken from its natural state.

WHY DOES MY STOMACH HURT? AND WHY DO MY JOINTS ACHE, AND MY BOWELS RUMBLE, AND MY FEET SWELL, AND MY …

It's not wheat. At least it's not the wheat of 1950, and certainly not the wheat of centuries past. It's no more wheat than rapper Snoop Dogg is Wolfgang Amadeus Mozart.

This creation of the genetics laboratory is different, altered in fundamental ways that increase appetite, ignite inflammation, grow visceral fat, skyrocket blood sugar, destroy intestinal and joint health, and wreak a long list of other havoc on health and metabolism.

WELCOME TO THE WONDERFUL STATE OF WHEATLESSNESS

If consuming modern wheat makes us fat and destroys our health, then removing it should undo the entire mess … and it does!

Remove sugar and you lose a few pounds and blood sugar trends down. Remove wheat and joints feel better, acid reflux goes away, rashes disappear, mental "fog" disappears, energy increases, sleep is deeper, food obsessions are gone, asthma improves or disappears, leg swelling shrinks—oh, and you lose a few pounds and blood

sugar trends down. Nothing—*nothing*—matches the health impact of losing the wheat, the "healthy whole grains," in your diet.

We go one step further: If you eliminate wheat, health and weight are not necessarily ideal if you continue to consume soft drinks, gumdrops, and their dietary equivalents. So we also discuss why limiting nonwheat carbohydrates is important, too, especially if you are trying to lose weight.

We then tackle the day-to-day particulars in …

ASSEMBLING YOUR WHEAT BELLY KITCHEN

Here we discuss everything from what to banish from your kitchen to what wheat-free flours to choose to re-create cupcakes, cookies, and cheesecake. Life is good after saying goodbye to wheat! You are healthier, more energetic, and more slender—while indulging in delicious brownies and pizza.

Okay, let's get started and kiss your sorry wheat-consuming butt goodbye!

FRANKENGRAIN

… it is true that I am a wretch. I have murdered the lovely and the helpless; I have strangled the innocent as they slept and grasped to death his throat who never injured me or any other living thing. I have devoted my creator, the select specimen of all that is worthy of love and admiration among men, to misery …

MARY SHELLEY

Frankenstein; or, The Modern Prometheus

WHEAT ENCAPSULATES a fundamental dilemma of our technological age: How much should we permit modern agriculture to modify our food, change its genetics, alter its biochemistry—but not tell us *what* they did, *how* they did it, *why* they did it, and that there are potentially uncertain effects on us unwitting humans who consume it with our breakfast burrito?

If your hairdresser one day decided to give you a new hairdo and dye your curls red, surely she would discuss this with you first. If your spouse decided that life would be better in Anchorage, Alaska, wouldn't it first come with a bit of discussion?

The production of our food does not seem to adhere to such common courtesies. Food crops and livestock are changed, you buy them, you eat them—no questions asked. The changes introduced are not just that of a new color, or an adaptation to grow under some unique condition. The food is, in many cases, fundamentally changed.

More than any other common foodstuff, wheat stands apart as the most changed. Selling bread, pretzels, or ciabattas to you under the guise of wheat is a deception that you would not tolerate in other areas of your life, certainly not from your hairdresser or spouse.

Modern wheat represents the technological capabilities of agricultural geneticists that predate the age of genetic engineering and genetic modification, the use of gene-splicing technology to insert or delete a gene. Wheat represents the brainchild of genetics manipulations that were employed before such technologies were developed. Wheat represents the product of genetic methods that were crude, often stumbling, less controllable, less predictable—*far worse* than genetic modification. Yes, believe it or not, modern genetic modification using gene-splicing technology to insert or delete single genes, as frightening as it may be in its implications to mess with nature's design, represents a substantial *improvement* over what geneticists were doing previously.

Using breeding methods that predate genetic modification, geneticists were unable to precisely control which genes were changed, which genes were turned on or turned off, and whether entirely new and unique genetic traits were created by accident. They simply looked for the characteristics relevant to their own interests, such as shorter height or greater yield, but had no real interest in nor insight into what the total package did to humans. Why would they, since none of us ever asked?

And yet the products of these stumbling early efforts at creating "improved" genetic variations of your food are already on your store shelves. And you've been consuming them for something

like 35 years.

Healthy Whole … What?

“Healthy whole grains.” It is the mantra you hear and see repeated dozens of times each day in TV commercials, on cereal boxes and bread wrappers, and by well-meaning people offering nutritional advice. The message is delivered by happy moms, sports figures, superheroes and well-dressed leprechauns, well-intended nutritionists and concerned physicians. Whole grains are good for everybody, they say: every man, woman, and child, from infancy on up to our retirement years. Whole grains reduce weight gain, colon cancer, diabetes, and heart disease. Whole grains make you regular. Whole grains should represent the biggest part of your diet every day.

Just what are “healthy whole grains”? By “grains,” we nearly always mean wheat. After all, how many times a day do you sit down to a sandwich with bread made of sorghum flour, breakfast cereal made of quinoa, or pancakes made with millet and buckwheat? If you are like most people, it is rare to never. It’s wheat that constitutes nearly all of what most people consider “whole grains” and thereby dominates consumption. Whole wheat, along with white flour products in their many and varied forms, dominates the diets of most people, adding up to 20 percent of all human calories. It’s wheat that’s in your pizza crust, bagels, pretzels, bread, pasta, muffins, breakfast cereals, doughnuts, hamburger and hot dog rolls, dinner rolls, bread crumbs and breading, pitas, wraps, subs, and sandwiches. And those are just the obvious sources.

Grains occupy the widest part of the former Food Pyramid, and now the largest segment of the Food Plate, the graphic renditions of the Dietary Guidelines for Americans. School lunch programs aim to include more “healthy whole grains,” and educators teach children that “healthy whole grains” should be a part of every child’s daily eating habits. Grains, we are told, are good for us, and without them our health will suffer.

So, just what is this thing called “wheat” that occupies a huge chunk of the modern diet?

It’s not what you thought it was. I would argue that it’s not wheat, or at least it is far removed from the wheat of 1950 that predates the extensive genetics transformations introduced during the 1960s and 1970s. But these crude genetics efforts were successful in delivering what geneticists were striving for: increased yield. To a lesser degree, efforts in wheat breeding were aimed at cultivating characteristics like resistance to drought or high temperature, or the ability to fight infestations like molds. But most of the genetic changes introduced into modern wheat were performed to increase yield-per-acre. And, from the perspective of yield, the new genetic strains of wheat were successful—on a grand scale. From the perspective of Third World countries, for instance, that adopted high-yield wheat strains in the 1970s, famine was converted to surplus within a year of their introduction. High-yield strains of wheat became cause for celebration.

But the day after the big party brings the … hangover. Sure, it yielded previously unimaginable riches in yield and fed the hungry. But at what price?

This modern product of genetics research looks different. Nearly all the wheat grown today in all parts of the world stands 18 inches to 2 feet tall, a semi-dwarf strain (full dwarf strains stand 12 to 18 inches tall) with a thick shaft that resists buckling in the wind and rain, a large seed

head, and larger-than-normal seeds. (Seeds are harvested to make flour.) With heavy nitrogen fertilizer application, modern semi-dwarf wheat yields tenfold more per acre than its traditional 4½-foot-tall predecessor.

But changes in height and yield are only the start. Outward changes in appearance are unavoidably accompanied by changes in biochemical makeup. Just one hybridization, for instance, of two parent wheat plants can yield 5 percent unique proteins not found in either parent. Modern high-yield, semi-dwarf wheat is not the result of a few hybridizations, but the result of thousands of hybridization events conducted by geneticists, repeated breeding to select for qualities like height and seed size, resulting in the creation of many unique proteins and other compounds. And breeding efforts ventured much further than just crossing two plants, often employing techniques we'd consider extreme or bizarre. It means that this new breed of wheat introduces hundreds of unique compounds to consuming humans never before encountered in nature. More on that later.

Problem: Geneticists assumed that, regardless of the degree of genetic changes introduced into the plant, no matter how severe the change in appearance, no matter how bizarre some of the methods used to generate those changes, it remains suitable for human consumption.

Tinkering with the Dinkel

Modern wheat is not wheat, any more than a human is a hairless chimpanzee.

As primates, we keep company with chimpanzees, orangutans, gorillas, and baboons. While apes have 48 chromosomes and humans have 46 (due to the fusion of two ape chromosomes), I'm certain you would object if I brought an orangutan to your home for dinner. Despite the extensive overlap in genetics, the outward differences are obvious. And there are internal biochemical and physiologic differences hidden beneath the obvious.

I have 46 chromosomes. You have 46 chromosomes. A Yanomamo tribesman from the Amazon rain forest has 46 chromosomes. A 4-foot-10-inch, dark-skinned Tasmanian Aboriginal woman has 46 chromosomes, as does a Nunavut Inuit hunter from northern Canada. There are marked outward differences among us humans, yet we all share an identical number of chromosomes.

Not so with wheat. Einkorn wheat, ancestor of all modern wheat, harvested by hunter-gatherers in the Fertile Crescent 10,000 years ago, is a 14-chromosome wild grain. The wheat of the Bible, emmer wheat, also grew wild in the Middle East and bears 28 chromosomes. Strains of wheat that predate human genetic intervention, the crop cultivated by humans during the Middle Ages through the 19th and early 20th centuries in North America and Europe, were 42-chromosome plants. Modern wheat of the 21st century is also a 42-chromosome plant. But our modern strains, thanks to genetic changes introduced by humans for our own purposes, contain new and unique characteristics, among them an inability to survive in the wild. Modern wheat is many thousands of years and many genes apart from 14-chromosome einkorn, 28-chromosome emmer, and even the 42-chromosome wheat of the 19th century.

The genetic story behind the evolution of wheat has only come to be appreciated over the last 100 years. In 1913, a German scientist named Schultz developed the first genetic classification of wheat. He divided wheat into three categories: einkorn, emmer, and dinkel. Five years later, a Japanese scientist performed a chromosomal analysis, making the

determination that einkorn contained 14 chromosomes, emmer 28 chromosomes, and dinkel 42 chromosomes. The dinkel of that day was pretty much untouched by genetic changes, representing only the crude year-over-year efforts by farmers to select for qualities such as hardiness and ability to survive a cold spell. (Since then, kamut has been identified as another 28-chromosome form of wheat and spelt another variation on 42-chromosome wheat.)

It's dinkel that now dominates the world's wheat and has been the recipient of all the attentions of geneticists. With 42 chromosomes, dinkel proved to be better suited to the tinkering of geneticists. Now called *Triticum aestivum*, dinkel wheat is a hardy "hexaploid" version, meaning it comes with three complete pairs of chromosomes ("hex" means six), unlike einkorn's single and emmer's two paired sets. The greater genetic potential of hexaploid *Triticum aestivum* means more adaptability and hardiness—and greater potential for genetic changes to be introduced by clever human geneticists.

So dinkel, 42-chromosome hexaploid *Triticum aestivum*, is the form of wheat that geneticists fiddled with, striving to increase yield-per-acre during the 1960s and 1970s. While the Cold War was smack in the center of consciousness at that time, the full realization of the power of science to do both good and bad had not yet focused on agriculture. Agricultural science was still young and full of promise, not yet having acquired the tarnished reputation that was to come in the future with herbicides like 2,4-D and 2,4,5-T (the two main components of Agent Orange, used to defoliate the jungles of Vietnam, Laos, and Cambodia, resulting in the maiming of hundreds of thousands of natives and American soldiers) and pesticides like DDT that were linked to infertility and birth defects.

During those years, agricultural geneticists worked free from concerns about toxicity and the implications for humans consuming the products of their genetic redesigns. It was still the age of science for the sake of science, with little to no thought devoted to potential consequences for exposed humans.

The techniques used to transform dinkel wheat involved plenty more than just mating two plants. The current strains of wheat—high-yield, semi-dwarf strains—were generated using repetitive hybridization (crossing two strains), wide crossing (crossing two very dissimilar plants, even distantly related wild grasses, to generate unique genetic combinations), repetitive backcrossing (repeatedly crossing to winnow out a specific genetic characteristic), embryo "rescue" (artificially sustaining an embryo of a hybrid that would have died naturally due to mutations), and chemical, gamma ray, and x-ray mutagenesis (the purposeful provocation of mutations, followed by cultivation of desired mutants). Most modern strains are the result of many, if not all, of these techniques.

Semi-dwarf wheat started with the 42-chromosome mutant spawn of the Norin 10 dwarf strain from Japan and the Brevor 14 strain from Washington. Progress in developing an especially high-yield strain of wheat was accelerated with the dedication and ingenuity of Dr. Norman Borlaug and colleagues working in Mexico City at the International Maize and Wheat Improvement Center (IMWIC). Thousands of hybridization experiments, crossing strains repeatedly, shuttling seeds back and forth between two very different climates (the high-temperature, low-altitude plains of the Yaquí Valley and the lower-temperature, high-altitude mountains of the Sierra Madre Oriental), helped create a unique, never-before-seen strain of wheat: exceptionally high-yield (tenfold greater yield-per-acre), short (18 to 24 inches tall), with a thick stem and large seeds.

Mexican farmers quickly recognized the production advantages of this super-yielding strain. It was exported to other countries, including the United States, Canada, India, China, and elsewhere. Adopted reluctantly at first in the United States and Canada in the late 1970s because farmers thought it looked peculiar, word spread quickly about this new odd-looking semi-dwarf strain once the remarkable yield-per-acre became evident, and it was embraced widely by the early 1980s. By 1985, virtually all wheat grown in the United States and Canada was the high-yielding semi-dwarf strain. Today, nearly all wheat grown worldwide is the semi-dwarf strain, with only small odd pockets of older strains still under cultivation in southern France, parts of Italy, and the Middle East.

This brings us to the present. Today, the wheat products you are sold in the form of whole grain or white bread, bagels, cookies, cakes, pretzels, pizza, and breakfast cereals, as well as the myriad other clever ways food manufacturers have managed to transform this grain, originate with the semi-dwarf brainchild of genetics research.

It's not wild einkorn, it's not biblical emmer, it's not spelt or kamut of the Middle Ages, it's not the dinkel of the 19th century. Modern wheat with its newly introduced genetic changes is uniquely and genetically suited to accommodate our demands for increased yield, more desirable baking characteristics, and more pliable dough.

It's just not perfectly suited for human consumption.

What Changed?

While wheat has been a problematic food for as long as humans have consumed it (with records suggesting celiac disease, or intestinal damage from wheat gluten, for instance, as long ago as AD 100), modern changes introduced by geneticists made it much worse.

Now, if you take me at my word that wheat has been changed extensively at the hands of geneticists but don't care to know all the details, then skim the heavy stuff over the next several pages. But if you desire a deeper understanding of what exactly changed, then pour yourself another cup of coffee and read on. Warning: The discussion unavoidably gets a bit complicated for the next several pages. But there are truly important details here for those of you who want to know just what happened.

So what exactly changed?

First, there are obvious outward changes visible to the naked eye. The knee-high semi-dwarf plant has a shorter stalk that diverts less fertilizer and nutrients from the seeds. This change in height is due to changes in Rht (reduced height) genes that code for the protein gibberellin, controlling stalk length (discussed later). The seed head is larger, with seeds that are also bigger and different in shape. While there is variation among the 25,000 modern strains, semi-dwarf wheat also tends to have reduced protein content and higher carbohydrate content, and it yields different baking and texture characteristics.

The differences in outward appearance are accompanied by internal genetic and biochemical differences.

Gliadin

Gliadin is among the most interesting—and most destructive—of all the many components of

modern wheat.

Gliadin is one of the proteins in the gluten family of proteins. Gluten is actually a combination of smaller gliadin proteins and lengthier glutenin molecules. While gluten is often fingered as the source of wheat's problems, it's really gliadin that is the culprit behind many health issues.

Gliadin can assume many forms, with more than 200 gene variants coding for as many variations of gliadin protein. The past 50 years of genetics research has introduced extensive changes into gliadin structure, but the full implications of these changes have not been fully mapped out, as they were assumed to be benign. And, after all, this research was performed by agricultural scientists, not physicians or people with insights into human health. Changes in gliadin have therefore been dismissed as harmless, despite the fact that gliadin is capable of increasing intestinal "leakiness" to foreign proteins and triggering cross-reactions with human structures (i.e., triggering an abnormal immune response to similar, though not identical, proteins in the body, a process called molecular mimicry), such as nervous system proteins like synaptin, cells of the intestinal lining (enterocytes), or the ubiquitous calcium-modulating protein calreticulin, potentially triggering inflammatory and immune responses to these proteins.

The changes introduced over the past 50 years in particular have increased the expression of the Glia-α9 amino acid sequence within gliadin that has been most closely linked to triggering celiac disease. While the genetic sequence coding for Glia-a9 was absent from most strains of wheat from the 19th and early 20th centuries, it is now present in nearly all modern varieties. Glia-a9 is a perfect fit for the transglutaminase enzyme that activates it into the form that strongly binds immune-activating ("HLA DQ") molecules lining the intestinal wall, activating the characteristic T-cell immune response that sets celiac disease in motion. The dramatically increased presence of Glia-α9 likely explains why there has been a fourfold increase in celiac disease since 1948. (Interestingly, the Glia-α9 sequence, coded for on the sixth chromosome of the "D" collection of genes in modern wheat, is also absent from primitive strains of wheat that lack "D" genes, such as einkorn, which contains only the "A" set of genes, and emmer, which contains the "A" and "B" sets of genes.)

Opiates, such as heroin, have been shown to activate appetite in addition to pain relief and euphoria. Likewise, the new forms of wheat gliadin have been shown to have effects on the human brain via binding to opiate receptors—yes, opiate receptors, the very same receptors that are activated by heroin, morphine, and Oxycontin. The opiate-like effects of wheat gliadin, however, are less of a "high" and more that of increased appetite and increased calorie consumption, with studies demonstrating a very consistent increased calorie intake of 400 or more calories per day (see "Wheat Gliadin and Exorphins: The Ultimate Obesogens" on page 10). Blocking gliadin with opiate-blocking drugs like naloxone and naltrexone has been shown to reduce calorie consumption by 400 calories per day and induce weight loss of 25 pounds over 6 to 12 months.

Glia-α9 represents just one change introduced into so-called a-gliadins. Changes have also been introduced into the three other fractions of gliadin, including the O-gliadin responsible for some forms of wheat allergy and anaphylaxis, and γ-gliadin that, along with the *a* form, bind HLA DQ. The full effect of these changes, given the widely held assumption that wheat is good for health, has not been fully explored.

Gluten

Gluten is the stuff that confers the viscoelastic properties that are unique to wheat dough, the stretchability and moldability that allow it to be so accommodating to bakers and shapeable into so many varied configurations, from pretzels to pizza. Gluten is also popular as an additive to processed foods like sauces, instant soups, and frozen foods, causing the average person to ingest from 15 to 20 grams per day.

Gluten is a diverse collection of proteins that vary from wheat strain to wheat strain. Gluten is the recipient of much genetic manipulation, as the long chain and branching structure of the glutenin proteins within gluten determine baking characteristics (firmness, sturdiness, bendability, stretchability, crust formation). Geneticists therefore bred and crossbred wheat strains repeatedly to achieve desired baking characteristics, bred wheat with nonwheat grasses to introduce new genes, and used chemicals and radiation to induce mutations that included new and unique changes in glutenin characteristics.

In addition to adding lightness to doughnuts and chewiness to wraps, gluten is also among the most destructive of proteins in the human diet, thanks to its ability to bind to what are called HLA DQ proteins (via gliadin) along the insides of the human intestinal tract. People with specific genetically determined forms of the HLA DQ proteins, such as DQ2 and DQ8, are especially prone to this effect, yielding inflammatory responses that result in celiac disease or sensitivity to gluten. Up to 30 percent of the population has either the DQ2 or DQ8 genes—by no means rare, though only around 1 percent of people with either DQ gene will develop the full-blown celiac disease syndrome, while another 10 percent develop gluten sensitivity. (It's not entirely clear why some people develop gluten sensitivity with symptoms of abdominal cramps, gas, diarrhea, etc., while others develop more severe celiac disease.)

Other important changes have been introduced into gliadin proteins of gluten (see page 9), including enrichment of the more harmful Glia-α9 sequences that likely underlies the quadrupling of celiac disease over the past 50 years.

Wheat Gliadin and Exorphins: The Ultimate Obesogens

Obesity research has raised an intriguing question: Are we being exposed to industrial chemicals that cause weight gain and contribute to the obesity epidemic? Bisphenol A (BPA), which is found in polycarbonate plastics and the resin lining of cans, and the pesticide atrazine, for instance, are two compounds suspected to provoke weight gain by blocking or distorting various glandular responses. These chemicals have been dubbed *obesogens*—compounds that cause obesity.

Could something new in wheat also be an obesogen?

The gliadin proteins of wheat are degraded in the gastrointestinal tract to a group of polypeptides named *exorphins*, or exogenously derived morphine-like compounds. Several different exorphin compounds, called gluteomorphin or gliadorphins by researchers studying these curious compounds over the last 30 years, have been identified. Not only do wheat-derived exorphins bind to the brain's opiate receptors, but they are blocked from interacting with brain opiate receptors by the opiate-blocking drugs naloxone and

naltrexone, the very same drugs used as antidotes, for example, for heroin or narcotic overdose.

So what is the evidence that the opiate-binding compounds that derive from wheat gliadin, in particular the newest forms of gliadin in modern wheat, via wheat exorphins, stimulate appetite? Here's a sampling of the research.

- Celiac disease, intestinal destruction from wheat gluten/gliadin, is traditionally regarded as a condition yielding emaciated, malnourished people, but has, over the last 40 years, become a disease of the overweight and obese.
- Overweight people with celiac disease who eliminate all wheat and gluten *lose 26 to 27.5 pounds of weight in the first 6 months*. Growing, overweight children with celiac disease lose fat mass and return to normal body mass index (BMI) with elimination of wheat and gluten. (These effects, by the way, tend to be short-lived because of the common mistake of resorting to weight-increasing gluten-free foods.) Note that in all of these studies, weight was lost without restricting calories, grams of fat, or anything else except eliminating wheat and gluten (and thereby gliadin).
- People who eliminate wheat consume, on average, *418 fewer calories per day*, or 14 percent fewer daily calories compared to wheat-consuming people in another study.
- Normal volunteers injected with the opiate-blocking drug naloxone consumed *400 fewer calories* in 1 day's time compared with those administered a placebo.
- People who suffer with binge-eating disorder (who often experience binge and "purge" cycles and are usually obese) consume 28 percent fewer calories during a binge after administration of naloxone.
- Multiple studies have recently demonstrated the efficacy of the oral opiate-blocking drug naltrexone (in combination with the antidepressant bupropion) for weight loss. Participants receiving the combination drug lost 25 pounds over the first year and experienced substantial reduction in food cravings. (These studies served as the basis for a pharmaceutical company's 2010 application to the FDA for a weight-loss indication for this drug.)

This is perfectly in sync with what I witness in my office every day, what I've witnessed over the past 5 years in people who have eliminated all wheat from their diet, and what I have seen unfold many thousands of times in the people who have read and followed the advice provided in *Wheat Belly*: Lose the wheat, lose the weight.

Wheat, in effect, is a powerful obesogen. Exorphins from the wheat protein gliadin increase appetite and increase calorie consumption by 400 or more calories per day; blocking the morphine-like effects of wheat exorphins with opiate-blocking drugs reduces calorie consumption and results in weight loss. The introduction of modern high-yield, semi-dwarf wheat in the late 1970s, with widespread adoption by 1985, was accompanied by a surge in weight gain, an explosive increase in the number of Americans classified as obese, and, after a lag of a few years, the greatest epidemic of diabetes ever seen.

Say goodbye to wheat, say goodbye to wheat gliadin and exorphins, say goodbye to excessive appetite, and say goodbye to weight—a lot of it.

The breeding methods used prior to modern techniques of genetic modification to alter gluten quality did not always result in predictable, controllable changes. For example, just one hybridization event between two different wheat plants can yield as many as 14 new glutenin protein sequences within gluten, the great majority of which have never before been consumed by humans. New genes for glutenin proteins within gluten have been described in modern forms of wheat that have never been found in older forms, such as the unique glutenin genes GluD3-3 and GluD3-12.

Usually as part of efforts to change the genetics of wheat to increase yield or enhance baking characteristics, new and unique gliadin, glutenin, and other proteins have resulted, none of which were tested for suitability for human consumption prior to their introduction into your food—they are just produced and sold, no questions asked.

Lectins

Lectins are a class of protective molecules found in plants. Lacking such things as cellular immunity and antibodies like we higher mammals have, plants instead rely on proteins called lectins to protect themselves from molds, insects, and other would-be predators. Because it is an effective defense against pests, geneticists have genetically engineered the gene for wheat lectin, wheat germ agglutinin, into other plants, such as corn, as an insecticide, given its lethal effects on the larvae of a pest known as the European corn borer.

The lectin of wheat, wheat germ agglutinin, is toxic. Found at highest concentration in wheat germ that many people regard as especially healthy, it has peculiar effects at many levels in wheat predators such as humans. Unlike gluten and gliadin, whose toxic potential is amplified in the genetically susceptible through HLA DQ genes, wheat germ agglutinin can do its damage directly, no genetic assistance required. It binds to the lining of the intestinal tract, disrupting cellular structure and microvilli, the short absorptive “hairs” on intestinal cells, and causing “hyperplasia,” i.e., abnormal cell growth, of the small intestinal lining. These phenomena increase intestinal permeability, suspected to explain why foreign substances are able to gain entry into the bloodstream in the presence of wheat germ agglutinin. Wheat germ agglutinin is unique in that it is resistant to digestion in the human gastrointestinal tract, as well as to cooking, baking, sprouting the seeds, or sourdough fermentation. Because of its relatively small size, in addition to allowing other intruding compounds into the bloodstream, it is itself readily able to penetrate the intestinal lining and gain access to the bloodstream, with many people expressing antibodies against wheat germ agglutinin.

Once it gains entry into the bloodstream, wheat germ agglutinin has the capacity to exert an entire range of peculiar and unhealthy effects, including amplifying the effects of insulin on fat cells (increasing fat storage) and stimulation of abnormal immune responses such as that underlying rheumatoid arthritis. Wheat germ agglutinin is believed to worsen celiac disease; studies suggest that wheat germ agglutinin alone is sufficient to generate celiac disease–like intestinal damage.

Oddly, wheat germ agglutinin resembles the protein hevein, the lectin from rubber plants responsible for latex allergy. The three variants of wheat germ agglutinin in modern wheat,