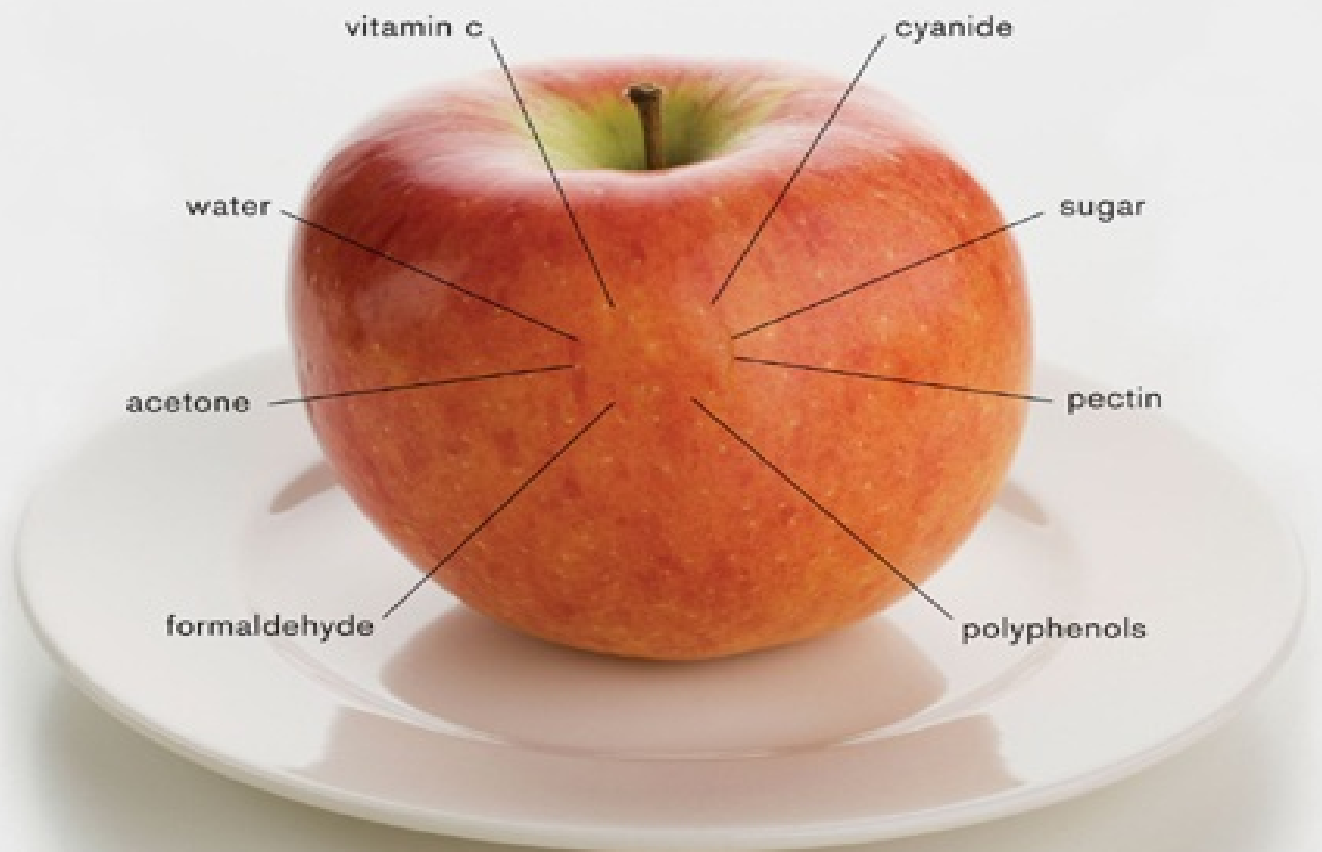


an apple a day

THE MYTHS,
MISCONCEPTIONS,
AND TRUTHS
ABOUT THE
FOODS WE EAT



JOE SCHWARCZ, PhD

AN APPLE A DAY

THE MYTHS, MISCONCEPTIONS,
AND TRUTHS ABOUT THE FOODS WE EAT



Joe Schwarcz, Ph.D.



OTHER PRESS
NEW YORK

Copyright © 2009 by Joe Schwarcz

Originally published in Canada in 2007 by
HarperCollins Publishers Ltd.

978-1-59051-328-6

Production Editor: Yvonne E. Cárdenas

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission from Other Press LLC, except in the case of brief quotations in reviews for inclusion in a magazine, newspaper, broadcast. For information write to Other Press LLC, 2 Park Avenue, 24th Floor, New York, NY 10016.

Or visit our Web site: www.otherpress.com

The Library of Congress has cataloged the printed
edition as follows:

Schwarcz, Joseph A.

An apple a day : the myths, misconceptions, and truths about
the foods we eat / Joe Schwarcz.

p. cm.

Originally published: Toronto : HarperCollins, 2007.

eISBN: 978-1-59051-328-6

1. Nutrition—Popular works. 2. Food—Popular works.
3. Food additives—Popular works. I. Title.

TX355.S3475 2009

363.8—dc22 2008021638

v3.1

It is a capital mistake to theorize before one has the data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts.

—SHERLOCK HOLMES

Almost all aspects of life are engineered at the molecular level, and without understanding molecules we can only have a very sketchy understanding of life itself.

—FRANCIS CRICK

CONTENTS

Cover

Title Page

Copyright

Epigraph

Introduction

PART ONE

Naturally Occurring Substances in Our Food Supply

An Apple a Day

Tomatoes and Lycopene

Cranberries and Procyanidins

Grapefruit and Furanocoumarins

Blueberries, Anthocyanins, and Pterostilbene

Citrus Fruits and Super Flavonoids

Acai Berries and Antioxidant Potential

Fish and Omega-3 Fats

Flax, Omega-3 Fats, and Lignans

Canola and Alpha-Linolenic Acid

Olive Oil and Oleic Acid

Soy Protein and Soy Isoflavones

Whole Grains and Insoluble Fiber

Oats and Soluble Fiber

Beans and Inositol Pentakisphosphate

Cabbage and Indoles

Broccoli and Sulforaphane

Spinach, Corn, Squash, and Lutein

Curry and Curcumin

Chocolate and Flavanols

Coffee Beans and Caffeine

Grapes and Resveratrol

Wheat and Gluten

Cinnamon and Methylhydroxychalcone

Vegetables and Salicylic Acid

Carrots and Carotenoids

Vitamins from A to K

Spinach and the B Vitamins

Oils, Nuts, Whole Grains, and Vitamin E

Cod Liver Oil and Vitamin D

Milk and Calcium

PART TWO

Manipulating Our Food Supply

Fortifying with Iron

Flavoring with Salt

Enhancing Taste with Monosodium Glutamate

Sweetening with Sugar and High-Fructose Corn Syrup

Cutting Calories with “Non-nutritional” Natural Sweeteners

Cutting Calories with “Non-nutritional” Artificial Sweeteners

Improving Taste with Artificial Flavors

Preventing Botulism with Nitrites

Preserving with Sulphites and Propionates

Preserving with Viruses

Preserving with Radiation

Coloring with Food Dyes

Improving Health with Bacteria

Boosting Immunity with Glutathione

Adding Fluoride to Water

Supplementing with Vitamins

Manipulating Genes in Our Food

Farming Organically

PART THREE

Contaminants in Our Food Supply

Pesticide Concerns

Acrylamide in Fried and Baked Foods

Antibiotic Residues

Hormones in Meat

PCBs in Fish

Trans Fats

Benzene in Beverages

Trans-4-Hydroxynonenal in Fried Foods

Substances Leaching from Plastics

The Bisphenol A Issue

Dioxins

PART FOUR

Tough to Swallow

The Miracle of Goji Juice?

Kosher Food Hype

The Questionable Health Properties of DHEA

Alkaline Nonsense

Losing Weight with Green Tea?

The Myth of “Detox”

Whom to Believe?

Conclusion: Is There a Solution to the Confusion?

INTRODUCTION

Eating used to be simple. As long as the food was tasty, looked reasonably appetizing and was plentiful, we were content. But then science came to dinner, and all of a sudden sitting down at the table became a laboratory experience, and a confusing one at that. Eat fish, we were told, it's chock full of omega-3 fats. Be careful, urged another report, fish may harbor "good" fats, but it's also loaded with PCBs and mercury. We switched to margarine from butter because it had fewer saturated fats. But then came accusations that the trans-fats it contained clogged arteries just like saturated fats. Eat soy, we were told, it lowers your cholesterol. Don't eat soy, it affects thyroid function. Drink milk, you need the calcium. Don't drink milk, it forms mucus. Drink coffee, it is full of antioxidants. Don't drink coffee, it raises blood pressure. Then there are those little gems that "they" say. Stay away from MSG. Don't touch foods preserved with nitrites. Or with sulphites. Beware of pesticide residues. Ban foods that contain genetically modified organisms. Don't cook in Teflon pots. Or use microwave ovens. Stay away from sugar. And don't even think about artificial sweeteners. But just who are "they"? We've been advised to load up on foods like oats, flax, mangosteen juice, garlic, and oregano because some researchers showed each of these to be of some benefit. Whole-grain bread may be in one day—lots of useful fiber and vitamins—but out the next because acrylamide, a purported carcinogen, was detected in the crust.

Many people throw up their arms in bewilderment at all this confusing nutrition information, and go back to their old dietary regimens. And that is too bad. Nutrition is important. The challenge is to separate the wheat from the chaff, and come to some practical conclusions about what to eat, based not on hearsay but on sound science.

This is not easy to do, especially when we consider that the human body is the most complex machine on the face of the earth. The diversity of its molecular components is so astounding that by comparison, computers, medical scanners, and space vehicles are simple devices. What we call life is really the result of astonishingly complex molecular activity that goes on in every cell in our body every second of the day. And where do the molecules that engage in these intricate gymnastics come from? One way or another, they come from the food we eat.

It seems obvious then that the composition of our diet can affect our molecular makeup, and consequently our health. But the relationship between diet and health is not a simple one. Food is chemically very complex. An apple, for example, is composed of over 300 different compounds. A single meal can flood the body with thousands of compounds, many of which have never been isolated or identified. While nutrition is obviously an important determinant of health, it is folly to think that one can introduce something as complicated as food into something as complex as the human body and make easy predictions about the outcome. Curing disease by dietary manipulation must therefore be looked at with a healthy degree of skepticism. But *preventing* disease by modifying our diet is realistic. The question is how?

Separating sense from nonsense has been the focus of my educational activities ever since I began teaching chemistry back in 1973. This book does not purport to be an encyclopedia of nutrition or a comprehensive guide to healthy eating. It does, however, provide a framework

for sound nutritional thinking, along with a perspective on what is worth worrying about and what is not as we ply ourselves with the *mélange* of molecules we call food.

People have different appetites when it comes to sampling food issues. Some are interested in the nutritional merits of specific foods; some are fascinated by the action of antioxidants and others worry about the safety of additives. Chances are that most of you will be as picky with this book as you are with your food. Each of the chapters in this volume has been designed to stand on its own and to provide you with up-to-date information on a specific food-related issue. In Part One, we examine the role played by food's natural components. What is there in tomatoes, soy, or broccoli that can contribute to good health? Why do gluten in wheat cause problems for some people? Part Two investigates the consequences of human intervention in our food supply. What are the risks and benefits of food additives and of genetic modification? What promise lies in adding specific bacteria to foods? Part Three deals with substances—such as pesticide residues, remnants of antibiotics, trans fats, and chemicals from plastics—that end up in our food supply unintentionally as a result of food processing. And for good measure, after you've waded through the science, in Part Four, we throw in a discussion of some dubious nutritional ideas.

These are all fascinating issues. Now, on to the fun part: let's try to digest them.



**NATURALLY OCCURRING SUBSTANCES
IN OUR FOOD SUPPLY**

Is there a better subject with which to begin a discussion of the relationship between food and health than apples? After all, doesn't "an apple a day keep the doctor away"? Maybe not, if you throw it at her! There is no single food that has magical health properties. There are good diets and there are bad diets. It is certainly possible to have a good diet and never eat apples, just as it is possible to gorge on apples and have a horrible diet. What really matters in terms of nutrition is the net effect produced by all of the chemicals that wend their way into our bodies from the food we eat. Yes, chemicals. I can practically see those eyebrows being raised. It may seem unusual to see the word *chemical* without an adjective like *poisonous*, in front of it. Actually, without appropriate context, *toxic chemical* is a meaningless term.

Take salicylic acid as an example. It occurs naturally in a variety of fruits and plants, including apples. It is also formed in our body when aspirin is metabolized. Indeed, salicylic acid is responsible for the physiological effects of aspirin, which include reducing the risk of blood-clot formation. That's why aspirin is used to treat a heart attack, and why it is commonly taken in small doses to prevent one. But in an overdose, salicylic acid can kill. Before childproof packaging was introduced, aspirin poisoning was a common cause of death in children. So how do we react if a test detects salicylic acid in our blood? Panic because of the presence of a "toxic chemical," or relief because of possible protection against heart disease? Of course, without the proper context there can be no appropriate reaction. To decide whether to laugh or cry, we need to know what blood levels of salicylic acid have been linked to risk and what levels to protection from disease. The mere presence of the chemical says nothing. As Paracelsus insightfully and wisely noted some 500 years ago, "Only the dose makes the poison." And to this we can add, "And only the dose makes the cure!"

So let's not get paranoid about chemicals in our food. Everything in the world is made of chemicals, and if you restricted yourself to a diet free of chemicals, you would be dining in a vacuum! With that in mind, let's investigate the chemicals in an apple. So tell me, would you like some nail polish remover in your diet? Or rubbing alcohol? Then have an apple! Yes, apples contain acetone and isopropanol. And if these don't sound toxic enough, you can throw in some cyanide. It's there too. Added by nature, not by humans! Should you then be worried about eating apples? Of course not! The amounts of these chemicals are too small to be of any consequence. Apples, as already mentioned, contain over 300 naturally occurring compounds, and whatever effect the fruit has on our health is a reflection of all of these. Researchers are particularly excited about one class of compounds, the polyphenols. Why? Because they have powerful antioxidant properties.

Chances are that if you haven't heard chapter and verse about antioxidants in recent years, you've been spending too much time in the butcher shop. These highly publicized substances are found in fruits and vegetables and can neutralize free radicals, those rogue molecular fragments produced whenever we inhale oxygen. We can't live without oxygen, of course, but there is a cost to be paid for living with it: illness and eventual death! About 2 to 3 percent of the oxygen consumed by our cells is converted into free radicals that are so reactive, they can rip other molecules apart. When the victims are proteins, fats, nucleic acids, or other

essential biomolecules, the result can be heart disease, cancer, or dementia. Even plain aging has been linked to cumulative free-radical damage.

Since antioxidants can mop up excess free radicals, they obviously merit serious scientific investigation. One of the difficulties, though, is the large variety of antioxidants that are present in plant products. Vitamins C and E, along with carotenoids, have received a great deal of attention, but most of the antioxidant activity of fruits and vegetables can be attributed to polyphenols. The term *polyphenol* actually refers to several related families of molecules that include the flavonoids, anthocyanins, chalcones, and hydroxycinnamates. To complicate things further, each family in turn comprises many compounds that are linked by some common feature of their molecular structure. As one might expect, because these antioxidants have different molecular structures, they also have different degrees of antioxidant activity. Obviously, knowledge about the distribution of polyphenols in our diet coupled with knowledge about which ones have the most activity, would be very useful.

But before we start jumping on the polyphenol bandwagon, we need to ask a pertinent question: What evidence do we have that polyphenols in the diet can contribute to good health? Demonstrating that these chemicals can neutralize free radicals in a test tube is one thing, showing that they can prevent cancer or heart disease is quite another. The first major study to suggest such a possible benefit appeared in *The Lancet* in 1993. Dutch researchers measured the amount of flavonoids in various foods, and by means of a dietary questionnaire assessed the flavonoid intake of 805 men ages sixty-five to eighty-four who were then followed for five years. Even when adjustments were made for smoking, body weight, cholesterol levels, blood pressure, physical activity, and vitamin and fiber intake, the polyphenol content of the diet was inversely associated with death from heart disease. The major sources of polyphenols in this study were tea, onions, and apples. A single apple a day made a difference!

There is evidence for the anticancer effects of polyphenols as well. Researchers at Cornell University found that treating colon or liver cancer cells in the laboratory with apple extract inhibited their proliferation, with extracts from the skin performing even better than extracts from the flesh. The same Cornell team also showed that apples may play a role in reducing the risk of breast cancer. Rats exposed to a substance known to trigger breast cancer were fed apple extract in amounts equivalent to a human eating one, three, or six apples a day. Lo and behold, the chance of developing the disease was reduced by 17, 39, and 44 percent, respectively! Even when cancer set in, maintaining the apple diet blocked the spread of the disease, and after six months reduced the number of tumors by 25 percent. And that with just one apple a day! These researchers did not stop at investigating cancer. When they exposed rat brain cells to a specific polyphenol, quercetin, they found that the cells resisted oxidative damage more, implying a potential reduction in the risk of developing Alzheimer's and other such brain diseases. Indeed, a group at the University of South Florida found a greatly reduced risk of Alzheimer's disease in seniors who drank fruit or vegetable juices at least three times a week compared with those who drank these juices less than once a week.

Other studies have found that quercetin reduces the growth of human prostate cancer cells in the lab and that its presence in the diet is inversely associated with the risk of lung cancer. This is not that surprising, given that quercetin has very potent antioxidant activity. And it is found in apples, along, of course, with many other polyphenols. But before we start

attributing magical properties to apples, let's realize that there are foods with high antioxidant potential. Red kidney beans, blueberries, and cranberries all have great antioxidant capacity per serving. And oregano has forty times the antioxidant activity of apples. What matters, though, is the total intake of polyphenols. Let's face it, eating apples every day is easy. Kidney beans are more challenging.

But the real key to antioxidant intake is variety. The more varied the fruits and vegetables consumed, the greater the chance that we equip ourselves with the complex array of antioxidants that may be needed for good health. Studies indicate we should be aiming for a daily polyphenol intake of around one gram. Apples, depending on the variety, can contribute anywhere from 100 to 300 milligrams. Eating a couple a day is certainly a good idea. And if someone tries to scare you by pointing out that apples contain embalming fluid, you can respond that whatever the detriments of the traces of the naturally occurring formaldehyde may be, they are more than countered by the benefits of the polyphenols. Eat those apples and make the undertaker wait longer with his embalming fluid.

TOMATOES AND LYCOPENE

Researchers are really excited about lycopene, the compound responsible for the red color of tomatoes. So is the public. Prompted by ads in magazines and by seductive promotions in health food stores, lycopene supplements are enjoying brisk sales, especially among men worried about prostate cancer.

Why should lycopene have any effect on prostate cancer? Because studies have shown that men who consume lots of tomato products have a lower incidence of the disease. A study by the Harvard School of Public Health showed that men who had ten or more servings of tomato-based foods a week had a 45 percent reduction in the rate of prostate cancer. Spaghetti sauce was the most common tomato-based food consumed, and cooked tomatoes seemed to be more protective than raw tomatoes or tomato juice, perhaps because heating releases lycopene and other nutrients from tomato cells. Also, the sauce is commonly made with olive oil, which enhances the absorption of the fat-soluble lycopene. And the sauce is a concentrated tomato product, so it provides more nutrients per gram than fresh tomatoes.

Lycopene is a good candidate for biological activity because the tomato actually uses the compound to maintain its own health. It protects the seeds in the fruit from damage by oxygen and light. Lycopene can absorb ultraviolet light, and its antioxidant activity allows it to neutralize free radicals generated by exposure to oxygen. Of course, there's more than lycopene in tomatoes. Like other plant products, tomatoes are very complex chemicals and contain hundreds of different compounds. Is lycopene the most important one? Researchers at Ohio State University decided to find out.

Since triggering cancer in humans is out of the question, researchers focused on rats, which actually are very good models for human prostate cancer. They caused prostate cancer in about 200 rats by treating them with a cancer-inducing mix of testosterone and N-methyl-N-nitrosourea. Some of the rats were then fed diets that contained whole-tomato powder while others were treated to rat chow fortified with lycopene. The lycopene-fortified rats were actually getting more lycopene than the tomato-powder rats. That's what made the results of the experiment so surprising. The risk of death from prostate cancer was significantly greater in the rats that were fed the pure lycopene extract! This would seem to suggest that there are other components in tomatoes that have a protective effect and that the whole food is beneficial, while isolated components may not be. True, the study was done in rats, but it does send us a message. Eat a balanced diet, with lots of vegetables and fruits, because shortcuts may not work.

There was another significant finding in this study. The researchers also put some of the rats in each group on a calorie-restricted diet. While their companions were allowed to eat as much as they wanted, these rats were given a diet that contained 20 percent fewer calories than what rats usually consume. Guess what? These hungry rats lived longer than the rats who ate freely. So, just eating less food reduces the risk of prostate cancer. What's the overall message for human beings? We should reduce our calorie intake and eat lots of tomato products. And eating those tomato products may even play a role in protecting the heart. At least that's one conclusion that can be drawn from an intriguing Italian study.

Imagine being admitted to a hospital with a heart attack and a doctor asking how many

times a week you eat pizza. This was the actual question that was asked of 507 heart attack victims and 478 others who had been admitted to a hospital in Milan, Italy, between 1990 and 1999. Why? To find out if most Italian foods had any role to play in heart disease. We've all heard about the benefits of the highly touted Mediterranean diet, and Italian researchers decided to find out if pizza specifically played a role in protection against cardiovascular disease.

After admission to the hospital, the patients were interviewed about their lifestyle habits and their diets. They filled out a seventy-eight-item food-frequency questionnaire on the basis of which they were divided into non-pizza eaters, occasional pizza eaters (one to four portions a month), and regular pizza eaters (more than one portion per week). Heart attack victims reported they had exercised less than controls, smoked more often, consumed more coffee, and drank less alcohol. No surprise here. They also had more of a history of high blood pressure, consumed more calories, and ate fewer fruits and vegetables. Still no surprise. But the surprise came when pizza eating was considered. Regular pizza eaters were 40 percent less likely to suffer a heart attack than those who never ate pizza! Why this should be so is somewhat of a mystery. Perhaps pizza eating is just an indicator of following a Mediterranean diet, which tends to be lower in fat than the North American diet.

We have to remember that we are talking about pizza as served in Italy, not the American version. No double cheese, no cheese-filled dough, no piles of pepperoni or globs of trans fat laden shortening. The dough is thin, the pizza is dressed with olive oil and cheese, and there is plenty of fresh tomato sauce. The answer to this pizza mystery may lie not in what the people are eating, but rather in what they are *not* eating. Perhaps the pizza is displacing high fat hamburgers and fries from the diet. Let's note that a portion of pizza in the Italian study was defined as 200 grams, and even the so-called regular eaters averaged only 500 grams (just over a pound) of pizza per week. Indeed, pizza may be displacing higher-calorie foods from the diet. Or maybe it's the yellow stuff around the tomato seeds that matters. This fluid contains flavonoids that have anticlotting properties, and could, at least in theory, reduce the risk of heart attacks.

The producers of Fruitflow certainly think this is the case. This patented tomato-extract product is being added to various drinks with hopes of improving cardiovascular health. In one study, blood "stickiness" was reduced by an average of 70 percent in 220 volunteers who drank a juice containing Fruitflow, with the effect lasting for eighteen hours. Tomato juice itself may provide a similar benefit. And it may be especially helpful on long-distance flights where a potentially life-threatening condition called deep-vein thrombosis can occur. Sitting in one position, such as in an airline seat, without moving for extended periods increases the chance of blood clots forming in the legs. These clots can travel to the heart or lungs and cause a catastrophe. So loading up on the tomato juice (without the vodka) is a good idea on long flights. Fruitflow is not the only tomato extract under investigation. Israeli researchers found that a supplement sold as Lyc-O-Mato, capsules that contain nutrients equivalent to those found in about four tomatoes (along with some fat to aid absorption), reduced moderately elevated blood pressure significantly. Hmm ... tomatoes and fat ... bring on the pizza! And top it with broccoli!

University of Illinois nutrition professor John Erdman fed a diet containing 10 percent dehydrated tomato powder, or 10 percent broccoli powder, or a combination of both, to rats

implanted with human prostate-cancer cells. Another group of rats was treated with supplemental lycopene, and yet another group was castrated, a possible treatment for prostate cancer. After twenty-two weeks, Erdman's team found that the tomato-broccoli combination was most effective in reducing the size of tumors. This was an animal study, so it is more meaningful than a test-tube experiment, but more importantly, the dose of broccoli and tomato needed to achieve the reduction in tumors is within the norms of the human diet. Conversion of the amounts fed to the animals to a human dose suggests that a cup and a half of broccoli a day coupled with two and a half cups of fresh tomato, or a cup of tomato sauce can be effective in reducing the growth of prostate tumors and probably in reducing the occurrence as well. Why a combination of broccoli and tomato works better than the individual foods is not known, but compounds in foods can inhibit cancer in various ways ranging from stimulating detoxicating enzymes to triggering cell death. Maybe there is a market out there for broccoli-flavored tomato ketchup.

Eating tomatoes may not only make you healthier, it may also make you look better. Lycopene is fat-soluble and concentrates in fatty tissue, such as the fatty layer just underneath the skin. Since the molecule is an efficient absorber of ultraviolet light, it offers some protection against sun-induced skin damage. In conjunction with the BBC television series *The Truth About Food*, two dermatologists in Britain put this notion to a test. They recruited twenty-three women aged twenty to fifty who were willing to bare their bottoms and expose them to ultraviolet light for the sake of science.

Half the volunteers consumed sixteen milligrams of lycopene daily, the amount contained in three teaspoons of tomato paste, along with ten grams of olive oil to help with absorption of the fat-soluble lycopene. The other volunteers got only the olive oil. Otherwise, both groups had identical diets. The results? Less reddening of the skin and less DNA damage in the lycopene group. And if you don't like tomato paste, a glass of tomato juice or a cup of tomato soup will do. But as for fresh tomatoes, well, you would need to eat at least half a dozen to achieve the same effects.

All of these intriguing studies have prompted producers to petition the Food and Drug Administration in the United States to allow health claims on the labels of tomato products. After all, foods containing soy and oats can have labels that claim they reduce cholesterol and calcium-supplement labels can claim that the supplements reduce the risk of osteoporosis, so why shouldn't tomato-product labels be allowed to make claims about reducing the risk of cancer? The FDA responds that there simply is not enough evidence to support the cancer-reduction claim. But the FDA does agree that there may be some health benefits to eating tomatoes. So it allows the tomato-product labels to include statements such as this: "Very limited and preliminary scientific research suggests that eating one-half to one cup of tomatoes and/or tomato sauce a week may reduce the risk of prostate cancer. The FDA concludes that there is little scientific evidence supporting this claim." Of course, the tomato producers believe that the FDA is too stringent in its requirements and that there is enough evidence about lycopene to warrant a stronger health claim.

Researchers at the National Cancer Institute and The Fred Hutchinson Cancer Research Center share the FDA's skepticism about lycopene. If lycopene does indeed offer protection from cancer, then people who have higher levels of this compound in their blood should have a reduced risk of cancer. But this does not appear to be the case. Researchers followed over

28,000 men between the ages of fifty-five and seventy-four who had no history of prostate cancer. During eight years of follow-up, 1,320 of the men were diagnosed with prostate cancer, but no relationship was found between the blood levels of lycopene and occurrence of the disease.

Of course, this research does not signal the end of the debate. We cannot just dismiss the studies that have shown an association between consuming tomatoes and protection from prostate cancer. Let's remember that tomatoes are chemically complex and contain numerous compounds besides lycopene, compounds that may—either alone or in combination with lycopene—act as anticancer agents. Perhaps the most important point is that the scientific evidence does not support the concept of a “superfood” or a “super” ingredient. Vegetables, fruits, and whole grains are loaded with compounds that have shown a potential for protection from cancer. Loading up on any single food or supplement is not the answer. The key is to eat a variety of foods that contain these beneficial chemicals, including, of course, tomato products.

Lycopene supplements may be useful in the future, but so far, there is no compelling evidence that these are as effective as tomato products.

CRANBERRIES AND PROCYANIDINS

Cranberries and turkeys make a pretty good combo. But so do cranberries and people. Don't worry, I'm not proposing cannibalism, just a scientific evaluation of the possible health benefits of cranberries.

Mention cranberry juice and "urinary tract infection" springs to mind. Most women and many men are familiar with the frequent urination and accompanying burning sensation that signals a bacterial invasion of the urinary tract. Today antibiotics solve the problem, but what did people do before? "Flushing the system" seemed a logical approach. I suppose all sorts of beverages were tried, but by the mid-1800s books on folkloric medicine were suggesting the use of cranberry juice. Based on anecdotal evidence, the juice developed a solid reputation for treating and preventing urinary tract infections.

Once bacteria had been identified as the cause of UTIs, scientists began to explore possible mechanisms by which cranberry juice could offer relief. Acidifying the urine to make it more inhospitable to bacteria was a possibility, as was the antibacterial action of hippuric acid, a component of cranberries. But trying to explain how cranberry juice worked before clearly demonstrating that it did was putting the cart before the horse. Finally, in 1994, Harvard researchers decided to mount a proper clinical study of the claims. They enrolled 153 older women, half of whom were given ten ounces (285 milliliters) of cranberry juice every day while the other half were given a look-alike drink containing no cranberry. The women who drank cranberry juice were 58 percent less likely to have levels of bacteria in their urine that would be expected to cause infections. As we would eventually learn, the effect was not due to acidity of the urine, nor to the antibacterial effect of hippuric acid. It had to do with compounds that prevented bacteria from adhering to the lining of the urinary tract.

Bacteria produce adhesives that enable them to stick to tissues so they can pick up nutrients more readily. These molecules fit into specific receptor sites on the epithelial cells that line the urinary tract. As was cleverly shown by Yale University researchers in 1999, compounds in cranberries block these receptors. Urine samples were collected from volunteers who were then given four ounces (115 milliliters) of cranberry juice to drink. Four to six hours later urine was again collected and incubated with *E. coli* bacteria, the kind that normally are responsible for urinary tract infections. The experiment was then repeated with eight ounces (230 milliliters) of juice. Separately, the scientists cultured cells taken from the lining of the human bladder and then mixed them with the urine samples. Lo and behold, the bacteria did not stick as effectively to the cells when the urine samples came from women who had consumed cranberry juice! Furthermore, the more juice consumed, the less the bacteria adhered to the cells. Although the specific ingredients in the juice responsible for this effect have not been conclusively identified, speculation is that substances known as trimeric procyanidins may be responsible.

These procyanidins may do more than prevent urinary tract problems. Most ulcers are caused by infection with the *Helicobacter pylori* bacterium. Well, it seems that the procyanidins may also prevent these bacteria from infecting the stomach. Researchers in China chose a population with a high rate of *Helicobacter* infection, and in a placebo-controlled, double-blind study, gave ninety-seven people 500 milliliters (just over two cups)

of cranberry juice for ninety days, while ninety-two others got a placebo. They found that *Helicobacter pylori* was eradicated in fourteen people in the cranberry group but in only five in the placebo group. Not an earth-shaking difference, but significant nevertheless, especially given the resistance problems we are now encountering with antibiotics.

Cranberries may even help reduce cavities by preventing *Streptococcus mutans* bacteria from clinging to teeth. These are the bacteria that digest sugars and convert them into acids that eat away tooth enamel. When researchers at the University of Rochester used cranberry juice to coat a sample of hydroxyapatite, the material of which tooth enamel is made, they found significant protection against bacterial adhesion. But nobody is suggesting swishing their mouth with cranberry juice. The commercial varieties often have loads of added sugar, not the best thing for the teeth, or indeed for the rest of the body, and you can't drink pure cranberry juice: it's much too sour. That's why researchers are trying to isolate the active ingredients in cranberries and make them available in a capsule form.

There may be even more to cranberries than their effect on bacteria. At the University of Western Ontario, twenty-four female mice were fed a normal diet for twelve weeks, twenty-four others drank cranberry juice instead of water, and another twenty-four had their diet supplemented with cranberry solids (the stuff left after the juice is squeezed) to make up ten percent of their chow. Then one week later, one million human breast tumor cells were injected into the animals' mammary glands. These were a special breed of mice, genetically engineered to have a compromised immune system, so they all developed cancer. But the ones that drank the juice took two weeks longer to be affected, and the ones that ate the cranberry solids took four weeks longer to develop tumors than the mice on ordinary lab food. Autopsies showed that ingesting cranberry cut—by more than half—the number of tumors that spread to the lungs and lymph nodes. Want even more good news? Researchers at the University of Prince Edward Island have shown that cranberries may even protect against brain damage caused by stroke.

So, you're now reaching for a glass of cranberry juice. Ready for the downside? Cranberries contain compounds that may inhibit enzymes used to break down certain medications. There have been a handful of reports of people on Coumadin (a common blood thinner) developing bleeding disorders after consuming cranberry juice. To be on the safe side, it seems a good idea for anyone on Coumadin to limit the amount of cranberry juice consumed. And one more thing. When researchers studied the ability of scents to stimulate men sexually, they found that the most enticing smell was a combination of lavender and pumpkin pie. The least enticing? Cranberry!

GRAPEFRUIT AND FURANOCOUMARINS

Grapefruit growers don't know whether to laugh or cry. There is some evidence that eating the fruit or drinking its juice can reduce blood cholesterol. But there are also those troublesome studies about grapefruit interfering with the effectiveness of certain medications, including some of the statin drugs used to fight high cholesterol. What a conundrum! Do we give up the juice or the drug? As you might expect, the situation is more complicated than it first seems.

“A chance finding of our study on ethanol–drug interactions was that citrus fruit juices may greatly augment the bioavailability of some drugs.” So began a paper published in 1991 in *The Lancet*, one of the most respected medical journals in the world. Dr. David Bailey and his colleagues at the University of Western Ontario had been studying felodipine, a blood pressure–lowering drug, and wondered if it interacted with alcohol. They decided on a double-blind trial in which some subjects were to take the drug with alcohol and some without. This meant that the taste of alcohol had to be masked, and after some experimentation Dr. Bailey concluded that grapefruit juice was up to the task. To the researchers' surprise, the alcohol had no effect, but in both groups the blood levels of felodipine were three times higher than expected. Bailey knew he was on to something. And he certainly liked a challenge. After all, he had been the first Canadian to run a sub-four-minute mile!

At this point, the eager scientist decided to become his own guinea pig. One day he took felodipine with water, the next day with grapefruit juice; each time he drew blood, and sent it for analysis of drug levels. He didn't have to wait for the results to confirm the “grapefruit effect.” After taking the medication with grapefruit juice, he began to feel faint and lightheaded, classic symptoms of low blood pressure. Clearly, when taken with grapefruit juice, felodipine lowered blood pressure more than expected. A number of questions immediately arose. By what mechanism was grapefruit juice increasing the drug's effectiveness? Did other juices have such an effect? What about interactions with other drugs? What would happen if the juice were consumed not with the drug but at some other time during the day? Was there a silver lining to this cloud? Could dosages of medications be reduced if they were taken with grapefruit juice?

Predictably, the *Lancet* paper unleashed a cavalcade of research. It wasn't long before studies showed that only grapefruit juice had this unusual effect. Some compound specific to grapefruit inhibited the action of CYP3A4, an enzyme found in the wall of the intestine. This enzyme is part of the body's detoxicating system and tackles intruders, such as medications. If its action is impaired, blood levels of these foreign substances can be expected to rise. Since CYP3A4 is known to be involved in the metabolism of numerous drugs, researchers suspected that felodipine would not be the sole medication to show a “grapefruit effect.” Indeed it was not. Various oral medications, ranging from heart-rhythm regulators and immunosuppressants to estrogen supplements and AIDS treatments, all interact with grapefruit juice. And this effect can last as long as twenty-four hours, meaning that drinking grapefruit juice at any time is contraindicated when taking drugs metabolized by CYP3A4. Since it isn't completely clear which drugs fall into this category and which do not, and because of the know-

variation in CYP3A4 levels in different individuals, some experts suggest that grapefruit juice be avoided when taking any medication. Accordingly, many hospitals have taken grapefruit juice off the menu.

The grapefruit industry has complained that it is being unfairly singled out. Spokespeople maintain, correctly, that there are numerous drug–food interactions. Dairy foods can interfere with some antibiotics, broccoli can reduce the effect of anticoagulants, foods high in tyramine (aged cheese, red wine, soy sauce, sauerkraut, salami) can cause dramatic rises in blood pressure when coupled with antidepressants of the monoamine oxidase (MAO)–inhibitor variety, and the absorption of digoxin (taken for congestive heart disease) is impaired by cereals such as oatmeal. While all of this information is factual, the existence of such effects doesn't let grapefruit off the hook.

So if, as mentioned earlier, grapefruit juice lowers cholesterol, why not forget the statins and just drink grapefruit juice? That's exactly what some people are asking after reading about Israeli researcher Shela Gorinstein's study showing that just one red grapefruit a day can reduce LDL, the "bad cholesterol" by as much as 20 percent. Furthermore, red grapefruit reduces triglycerides significantly. But wait a minute. Gorinstein's subjects all had recently undergone bypass surgery, had been resistant to statins, and were on a diet with only 10 percent of calories coming from fat. So these results cannot be readily extrapolated to your average North American who is diagnosed with elevated cholesterol. What can he or she do? First, eat a diet low in saturated and trans fats, with plenty of fruits, vegetables, and oat bran. And yes, grapefruit too! Throw in some persimmons, some pomelits (a cross between grapefruit and a pomelo), and pale lager beer, all of which have been shown by Gorinstein to reduce the risk of heart disease. And if that doesn't work, well, bring on the statins. But for now, not with grapefruit juice. That restriction may change in the future, thanks to researchers at the University of North Carolina who have identified furanocoumarins as the troublesome compounds in grapefruit juice and have shown that they can be removed. The resulting juice had no effect on blood levels of medications. This research may yet have another benefit. Perhaps furanocoumarins can be added to medications, reducing the doses needed and reducing the risk of side effects. These developments should make grapefruit growers somewhat less sour.

Life is sort of like walking a tightrope. We try to keep our balance as we struggle with diseases and aging, but we know that no matter what we do, eventually we will fall off. Obviously, anything that helps us stay on that rope longer is most welcome. And anthocyanins in blueberries may do just that. They sure do it for rats. At least that's what researchers at Tufts University in Boston found.

Why were these scientists interested in the unlikely combination of rats and blueberries in the first place? Because anthocyanins, the compounds responsible for the blue color of the berries, are powerful antioxidants. In fact, when different fruits and vegetables are tested for antioxidant activity, blueberries consistently rank near the top of the chart. And we know that antioxidants have been linked with inhibiting blood-clot formation, improving night vision, slowing macular degeneration, and generally reducing the risk of heart disease and cancer, as well as with protecting brain cells from aging. It is this anti-aging effect that captured the imagination of the Tufts researchers. First, a group of elderly rats was put on a blueberry-rich diet, while another group was treated to regular laboratory rat chow. Both groups were then exposed to high levels of oxygen for forty-eight hours. Inhaling extra oxygen produces copious amounts of free radicals. The idea was to study the effects of the free radicals on rats that had anthocyanins scurrying around in their bodies as compared with those that did not.

It is well known that free radicals can attack all sorts of molecules in the body, including those that play a role in the functioning of the nervous system. So it wasn't a great surprise that rats fed standard lab meals showed a significant impairment in neurological function when compared with the blueberry-treated rats. Apparently the anthocyanins were neutralizing the free radicals generated by the high dose of oxygen. But there was an even more important practical finding.

Rats enjoy walking on narrow ledges and beams, and are apparently very good at the practice—at least until they begin to age. Researchers can actually estimate the age of a rat by measuring the time it takes for the animal to lose its balance on a narrow beam. As rats reach the ripe old age of nineteen months, equivalent to between sixty-five and seventy years in a human, the average balance time drops from thirteen seconds to five. Older rats are also less adept at negotiating mazes, which of course is a real problem for a lab rat. But now comes the kicker. After eating blueberry extract for eight weeks, the old rats managed to stay on the rod for eleven seconds. They also negotiated mazes better! No great shock that the lay press seized upon this study, elevating blueberries to the status of a wonder food.

Of course there are no wonder foods. There are good diets and bad diets. And anthocyanins are present in various other fruits and vegetables as well. In fact, cherries are particularly rich in these compounds. Indeed, certain anthocyanins isolated from cherries have been shown to have anti-inflammatory properties, possibly useful in fighting arthritis. Even certain diabetics may respond favorably to anthocyanins in the diet. Dr. Muralee Nair at Michigan State University showed that in animal pancreatic cells, anthocyanins increased insulin production by some 50 percent.

The possible benefits of blueberries don't stop at anthocyanins. Recently researchers found

that pterostilbene, another antioxidant present in blueberries, may reduce cholesterol. Interesting, but the study in question was not done on humans, and not even on live animals. It was done in the laboratory on rat liver cells. The researchers did manage to show that pterostilbene activates a specific receptor on these cells that is linked with reducing cholesterol and triglycerides. But nobody knows if this compound when ingested from blueberries acts the same way in a human liver, or indeed if it even gets there. Nobody knows how many blueberries would have to be eaten to lower blood cholesterol, but for sure eating a blueberry muffin or a blueberry-studded bagel is not going to do it. Nor will blueberry pancakes. Eventually we may find that anthocyanin or pterostilbene supplements in a pill form are useful, but for now I try to eat half a cup of blueberries several times a week. I'm not sure exactly how beneficial this is in terms of health, but I am sure of one thing: the berries taste better than pills.

CITRUS FRUITS AND SUPER FLAVONOIDS

Take some hamsters and feed them lots of fatty stuff to drive up their blood cholesterol. Then add some *super flavonoids* to their feed and hope that they mitigate the effects of the high-fat diet. Why? Because if the flavonoids reduce cholesterol, you've got a marketable product. Even better, since the super flavonoids derive from orange peel, you've got a "natural" product with all the associated commercial appeal. Well, in hamsters at least, the orange peel extract does deliver the goods. And in the future, it is certainly possible that some sort of standardized version of *polymethoxylated flavones* (PMFs) extracted from orange peels may be recommended for people with high blood cholesterol. But let's not jump the gun.

To most people, cholesterol is a dirty word. If you go by information garnered from the media, you might get the impression that a diagnosis of high cholesterol should prompt a swift meeting with an undertaker. While it is true that high cholesterol is a risk factor for heart disease, it is only one of many. High blood pressure, family history of heart disease, diabetes, lack of physical activity, and exposure to polluted air all play a role. In fact, half of all people who have heart attacks have normal or below-normal cholesterol levels. Nevertheless, a finding of high cholesterol certainly should trigger efforts to reduce it. But how? Physicians often reach for the prescription pad and scribble instructions for a statin drug. These are highly effective medications, but they come with side effects. Muscle pain and liver problems are possibilities—and the cost of the drug can be considerable. So people search for kinder, gentler therapies, hoping to find efficacy in "natural" products, which are perceived to be safer than synthetic drugs. The truth, of course, is that the safety of a substance does not depend on its source but on its specific molecular structure. Whether it was made by a chemist in a lab or by nature in a bush does not matter. What matters are the results of studies that have been carried out on the safety and efficacy of the substance.

There is no shortage of cholesterol-reducing claims on behalf of dietary supplements formulated from natural products. Some, such as guggulipids extracted from the guggul tree, seem exotic, while policosanol from sugar cane or allicin from garlic sound more mundane. Promoters of all such products muster up studies to hype their wares, but the scientific consensus is that the evidence is pretty thin. Still, the search for truly effective natural products continues, and justifiably so. After all, it is pretty clear that populations consuming more fruits and vegetables tend to have lower cholesterol levels. The question is whether this is due to what they are *not* eating, such as fatty meats, or to the presence of substances in plant products that actually lower cholesterol. The quest for such substances has resulted in the isolation of a variety of natural compounds that have been examined for possible cholesterol-lowering effects. Among these are the polymethoxylated flavones (PMFs), such as tangeretin, hesperidine, and naringin, which are found in citrus peel.

Why are these compounds of particular interest? For several reasons. First of all, PMFs are antioxidants and therefore have the potential of preventing the conversion of cholesterol into its more dangerous oxidized form. Also, studies in cultured cells showed that, like the statin drugs, PMFs inhibit the synthesis of cholesterol and triglycerides (fats in the blood) in the liver. Add to this the fact that Florida alone produces about 700,000 metric tons of orange

- [click The Changed Man \(Maps in a Mirror, Book 1\) book](#)
- [click Corked & Forked: Four Seasons of Eats and Drinks](#)
- [read Problem Solving Survival Guide to accompany Intermediate Accounting \(15th Edition\)](#)
- [Learning To Breathe pdf, azw \(kindle\), epub](#)

- <http://www.rap-wallpapers.com/?library/A-Very-Nice-Glass-of-Wine.pdf>
- <http://www.mmastyles.com/books/Corked---Forked--Four-Seasons-of-Eats-and-Drinks.pdf>
- <http://fitnessfatale.com/freebooks/Problem-Solving-Survival-Guide-to-accompany-Intermediate-Accounting--15th-Edition-.pdf>
- <http://fitnessfatale.com/freebooks/Drugs--A-Very-Short-Introduction--Very-Short-Introductions-.pdf>