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IFIC FOUNDATION

food Insight™

*Current Topics in
Food Safety and Nutrition*

Inside Insight

Public Health Pop Quiz: Boning Up On The Facts	2
Newsbites	5
Weight Management And Healthy Lifestyle Through Small Changes And Balance	6

The Human Genome: A Double-Edged Helix

Revolutionary, unprecedented, unsurpassed. These adjectives are being used to describe the Human Genome Project's potential to benefit society. The understanding of the human genome that has been gained is almost certain to lead to breakthroughs in medicine that may ultimately eradicate many of today's diseases.

The previous two articles about the human genome in *Food Insight* ["Genomics 101: An Introduction to the Human Genome" (May/June 2001) and "The Human Genome: A Master Code for Better Health" (July/August 2001)] covered the potential benefits of the human genome, including:

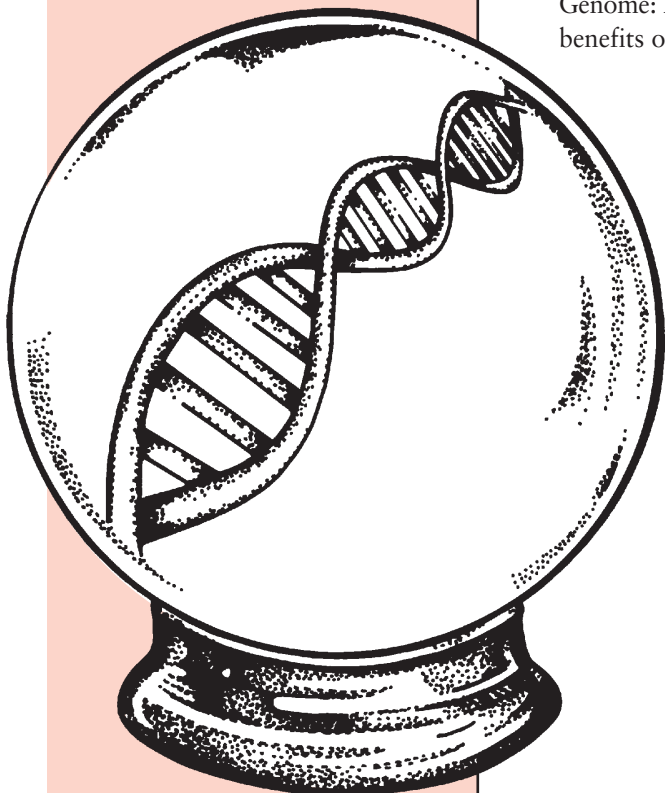
- Opportunities for the discovery of keys to individuals' genetic susceptibility to disease,
- Possibilities for the development of functional foods and drugs uniquely tailored to help manage that susceptibility, and
- Development of individualized dietary counseling and/or medical monitoring to provide support to those with a genetic predisposition to certain conditions.

This dynamic new technology also poses questions about safety, human rights issues, and moral implications, however. Finding the answers to questions like these may be as just as important (and just as complex) as making the technical discoveries that prompted them.

The Potential of Genetic Screening

As the cost of genetic testing decreases, it may become possible to screen groups of people for any genetically linked trait. This expanding capability will force some very tough decisions. For example, women with a mutation in either of the genes known as BRAC1 or BRAC2 are at a very high risk of developing breast cancer and ovarian cancer. A DNA test is available to identify carriers of this mutation, but the decision whether to undergo this test has profound implications.

Continued on page 4



PUBLIC HEALTH POP QUIZ:

Boning Up on the Facts

Question:

What disease affects 1 in 10 Americans (28 million), with healthcare costs of over \$14 billion a year? What disease poses a risk for Caucasian women that is equal to their risk for breast, ovarian, and uterine cancers combined? What disease receives relatively little public health attention, despite having reached epidemic proportions in the United States? What disease, despite being one of the most prevalent in America today, is also one of the most preventable?

Answer:

Osteoporosis.

Osteoporosis—or “porous bones”—occurs when bone loss outpaces bone formation, resulting in frail bones and an increased risk of fractures. The disease is most common in Caucasian and Asian women over the age of 50. Other groups, such as men and non-Caucasian women, are at a lower, although significant, risk.

Osteoporosis is a “silent” disease, meaning that a person may steadily lose bone mass over many years but remain symptom-free until his or her bones become so weak that they sustain a fracture. For many people, this proves to be a life-threatening event. One in two people who fracture a hip never fully recovers, and one in three-to-four people who fracture a hip dies within a year.

This is disheartening news for an aging American population. Seventy million Americans will turn age 65 by the year 2030, and many of these individuals are

at risk for osteoporosis and bone fractures. By then, annual healthcare costs due to osteoporosis in the United States are expected to reach \$60 billion. Widespread preventive measures must be taken to improve the bone health of Americans.

Preventing Bone Loss

Many factors contribute to the proper formation and maintenance of bones. These include diet, physical activity, hormone levels, and smoking status, among others. For example, postmenopausal women who undergo hormone replacement therapy (HRT) can stem bone loss and reduce their risk of fractures.

Eating for Strong Bones

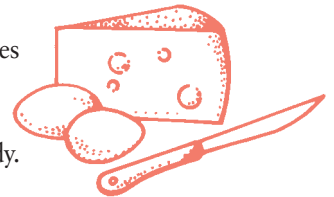
A plethora of vitamins, minerals, and other nutrients affect bone health, including calcium, phosphorus, magnesium, fluoride, and vitamins D and K.

Calcium is probably the most well studied nutrient with respect to bone health. The connection between calcium and bone health is a logical one, considering that about 99 percent of the body’s calcium is stored in bone. Therefore, the evidence is clear: consuming adequate amounts of calcium in the diet is imperative for both young and old individuals. Bone mass accumulates rapidly during adolescence, with 99 percent of bone minerals being deposited by the age of 22. The body comes to rely on this reserve in the later years of life, after bone formation has ceased. Studies have shown that adolescents who have high calcium intakes tend to develop greater bone density.



The same is true for older adults, who retain more bone density and have less bone loss when their calcium intake is high. Calcium is especially important during menopause, when women lose bone mass at a rapid rate. However, the rate of bone mass loss seems to be decreased by calcium supplementation.

Another nutrient important to bone health is phosphorus. Eighty-five percent of phosphorus in the body is found in bone, where it works with calcium to strengthen bones. Both calcium and phosphorus would be ineffective without the help of vitamin D. Therefore, the intake of adequate amounts of vitamin D ensures that calcium and phosphorus are absorbed by the body. Consumption of a combination of calcium and vitamin D seems to be especially effective in promoting bone health in elderly individuals.



There is preliminary evidence that fluoride, magnesium, and vitamin K also play roles in maintaining bone integrity. Scientific studies with these nutrients are under way to determine exactly how and to what extent they are involved in bone health.

In the meantime, it is wise to include all of these nutrients in a well-balanced eating plan. Refer to the chart on page 3 for foods that are good sources of these nutrients. Also, keep in mind that the *Dietary Guidelines for Americans* and the *Food Guide Pyramid* outline eating patterns that are beneficial to bone health.

Major sources of “Bone-Building” nutrients

NUTRIENT	MAJOR SOURCES
Calcium	Dairy products (milk, yogurt, cheese), green leafy vegetables (kale, collards, broccoli), fortified orange juice, tofu (set in calcium).
Phosphorus	Meat, poultry, fish, eggs, milk products, nuts, legumes.
Magnesium	Seeds, nuts, legumes, dark green vegetables.
Fluoride	Fluoridated drinking water, foods prepared with fluoridated water.
Vitamin D	Fortified milk, fatty fish (salmon, herring), exposure of skin to sunlight.
Vitamin K	Leafy green vegetables (spinach, kale, broccoli, dark lettuce), margarine, plant oils.

Testing Theories:

It has been shown that caffeine consumption causes a slight and temporary rise in the level of excretion of calcium (reversed within a few hours), leading to speculation that the use of caffeine could compromise bone health. The results of scientific studies in this area have failed

to confirm this theory, although it has been found that individuals who have low calcium intakes have increased bone loss. The bottom line is that a person’s bone health should not be affected as long as calcium intake is adequate.



It has been hypothesized that consumption of soft drinks may indirectly compromise bone health status by displacing calcium-rich beverages, such as milk, from the diet. However, the research surrounding this

“displacement theory” is not definitive.

Soft drinks can be enjoyed in moderation as part of a bone-healthy diet, as long as bone-building nutrient requirements are also met.



The Benefits of Activity

There is no denying the fact that physical activity leads to better health. Physical activity has proved beneficial in reducing the risk of chronic diseases such as heart disease, cancer, diabetes, and obesity. The results of numerous studies strongly suggest that bone health is no exception.

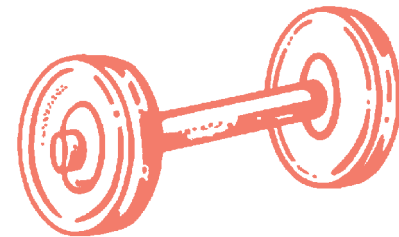


Vigorous activities such as weight lifting, aerobics, tennis, dance, walking, and running help build bone mass and slow bone loss throughout the life cycle. These activities also enhance muscle strength and improve coordination, which help reduce the risk of fall-related bone fractures.

Some studies suggest, however, that physical activity need not be vigorous to improve bone health. People who regularly engage in lower-intensity movement, such as gardening and leisurely walking, have been shown to reap the benefits of stronger bones. On the flip side, those who are considered sedentary (those

who sit at least nine hours per day) have been shown to be at greater risk for a hip fracture.

There is no question that regular physical activity improves bone health; the only questions are how much? how often? and for how long? Researchers are working to answer those questions, but for now, consumers should continue enjoying an active lifestyle to build and keep strong bones.



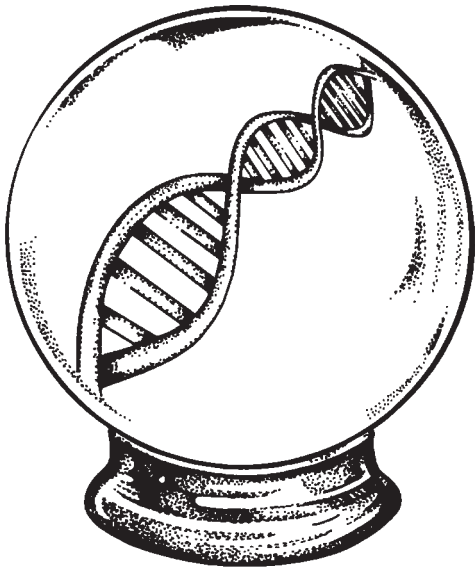
For More Information on Bone Health and Osteoporosis

National Institutes of Health: Osteoporosis and Related Bone Diseases National Resource Center: <http://www.osteoporosis.gov>

National Osteoporosis Foundation: <http://www.nof.org>

USDA Center for Nutrition Policy and Promotion (Food Guide Pyramid and Dietary Guidelines): <http://www.usda.gov/cnpp>

International Food Information Council Foundation: <http://ific.org>



The Human Genome: A Double-Edged Helix

Continued from page 1

Why Undergo Genetic Screening?

Currently, the only sure way to prevent breast cancer is prophylactic mastectomy, but conscientious use of self-examinations and regular mammograms can detect the disease at an early stage when treatment is very effective. On the other hand, ovarian cancer is far more difficult to detect, and the option of a prophylactic ovariectomy may be acceptable to some high-risk women—especially those beyond reproductive age. Another factor affecting this decision is that our understanding of cancer and other degenerative diseases is rapidly increasing, and so the discovery of an outright cure during the next few decades is a very real possibility. The decision to undergo genetic screening is therefore a very difficult one to make, but an informed choice involving consultation with family and health care professionals is the best solution.

One advantage of genetic screening could be to help an individual make informed decisions about, for example, becoming a parent; planning a career; choosing investments; or deciding about insurance coverage, travel, or education. The knowledge that one is predisposed

to cancer, however, could have negative effects in countless other areas including mood, self-confidence, ambition, and setting future goals. Also, what if others learn of this information? Will a high-risk person be treated differently by her or his spouse, employer, or insurance company?

To date, there is little evidence that insurance companies or employers discriminate against individuals on the basis of genetic makeup or the results of genetic screening tests. Insurance executives have defended the industry by noting that the cost of widespread genetic screening may be prohibitive, that most people are insured as part of a group so the cost to treat any one individual is relatively trivial, and that companies don't want to risk damage to their image by being accused of genetic discrimination.

For example, public pressure was a critical factor in a recent incident involving a major railway company. The company had initiated genetic testing for some of its employees to determine susceptibility to carpal tunnel syndrome, but the company quickly discontinued the testing when the media reported that it was being done. Despite the protection offered by public pressure—as well as federal legislation, which has been passed and implemented—concerns about possible discrimination on the basis of one's genes are likely to persist.

Modifying the Human Gene Pool in Theory and in Practice

As our ability to screen for genetic characteristics increases, it will be possible to alter the human gene pool by selectively determining which pregnancies are carried to term. Theoretically, this technique could be used to identify “undesirable” genes in an effort to reduce their frequency and gradually improve the human genome.

The central questions regarding this practice relate to the contentious issue of reproductive rights. Inherent in the

decision to genetically screen an embryo may be the willingness to terminate the pregnancy if a defect is found. The appropriate criteria (if any) on which this decision is based are grounded in the value systems of the parties involved. But where will the line be drawn? The answer requires the formidable task of finding an acceptable balance between moral and ethical fundamentals on the one hand, and individual freedoms on the other.

Moral Concerns and Future Research

At the earliest stage of development, all cells in an embryo have the capability to develop into any tissue in the body. Animal experiments with such cells (and early studies with humans) have shown that they have great promise for the treatment of Parkinson's disease, juvenile-onset diabetes, and possibly many other diseases including cancer and heart disease. Scientists are eager to extend this work to studies with humans, but the ethical issues have become a major consideration.

Other highly controversial areas of genetic research include inserting human genes into animal organs in an effort to make them suitable for transplantation into people, and cloning. The major medical advances that will arise from the use of these techniques have the undeniable potential to extend human life expectancy, but the debate on this enormously complex topic is far from over and science will continue to evaluate these areas of genetic research.

Legal Considerations – “My Genes Made Me Do It!”

DNA testing is now routinely used to help solve crimes, but the impact of genetics on the judicial system will be far more complicated. Data from the Human Genome Project suggest that certain mental conditions and behavior patterns are linked to specific genes. For example, scientists suspect that a defective gene on

human chromosome 6 predisposes individuals to schizophrenia, and deviant behavior may also be genetically influenced. If this hypothesis is confirmed, should affected persons convicted of a crime be punished even though their actions were genetically preprogrammed? If negative behaviors are linked to genes, should individuals be screened for such genes at birth? What measures (if any) are appropriate to prevent such individuals from committing the crimes to which they are predisposed? The debate on such complex issues is only beginning to unfold, but rapidly evolving technology will soon demand answers.

Where Do We Go from Here?

After 10 years, scientists have nearly completed sequencing the 3 billion base pairs of the human genome. Given the societal implications, that may have been the easy part. The world now stands on the threshold of a new age in biology that promises both enormous hopes and enormous concerns. Clearly, there is no going back—the potential benefits and the quest for knowledge are too compelling. Logic suggests that the stakes of this new game are too high to permit our zeal for technical advancement to short-circuit our ability to control it. Humanity has historically thrived on emerging technologies, and human genomics provides another opportunity to apply our accumulated wisdom as we judiciously meet the exciting but daunting challenges of the future.

NewsBites

Present Knowledge In Nutrition

The eighth edition of this nutrition classic, *Present Knowledge in Nutrition*, published by the International Life Sciences Institute Press, is hot off the presses. In continuous publication since 1953, *Present Knowledge in Nutrition* has been thoroughly revised and is an essential reference for inclusion on the bookshelves of dietitians, physicians, researchers, food industry scientists, educators, students, nutrition policy makers, and other nutrition professionals.

This affordable resource includes up-to-date, accurate, and comprehensive information on macronutrients, micronutrients (including the new Dietary Reference Intake values), disease correlations, and the other fundamentals of nutrition science. The editors, distinguished nutrition scientists from public health and medicine, worked closely with an international editorial advisory board to ensure the book's timeliness and broad appeal to a global audience.

The 65 fully-referenced chapters are organized into sections on energy physiology, macronutrients, fat soluble vitamins, water-soluble vitamins, minerals and trace elements, nutrition and the life cycle, physiology and pathophysiology, nutrition and chronic disease, nutrition and pathophysiology, international nutrition, and emerging issues.

To order a copy of *Present Knowledge in Nutrition* (\$89.00 plus shipping and handling; order code 811074-a), contact International Life Sciences Institute Press by one of the following means: by telephone at 202-659-0074, ext. 123; by fax at 202-659-8654; by email at ilsipress@ilsi.org; or by mail sent to ILSI Press, One Thomas Circle NW, 9th Floor, Washington, DC 20001.

The National Academy of Sciences Says Bt Corn is Safe for Monarch Butterflies

On September 14, 2001, the National Academy of Sciences released the results of a study that looked at 2 years worth of data from five universities across the United States and Canada. The research was conducted following several claims that Bt corn (a type of corn produced through biotechnology to resist the European corn borer – an insect that destroys corn) was harmful to Monarch butterfly larvae.

The findings show that the most commonly used types of Bt corn have no adverse effects on Monarch butterfly larvae.

The study was funded by a pooled grant from the U.S. Department of Agriculture (USDA), the Maryland Agricultural Experiment Station, the Agricultural Biotechnology Stewardship Technical Committee (a coalition of companies that produce corn enhanced through biotechnology), the Canadian Food Inspection Agency, Environment Canada, the Ontario Ministry of Agriculture, and the Leopold Center for Sustainable Agriculture.

The results of the study and the six papers that make up the research are available to the public through the Environmental Protection Agency and on the National Academies of Science Web site, <http://www.pnas.org/papbyrecent.shtml>.

Weight Management and Healthy Lifestyle Through Small Changes and Balance

Since the revised definitions of overweight and obesity appeared in 1998 in the form of the Body Mass Index, the term “obesity epidemic” has become part of our everyday language. Numerous government reports, scientific studies, and media reports have documented the problem and illustrated the alarming increase in the number of obese individuals—both adults and children—over the past two decades.

In the United States alone, rates of overweight and obesity have skyrocketed—more than 61 percent of Americans are now considered overweight or obese. Twenty-five percent of children are classified as either overweight or at risk for overweight—more than double the rate of a generation ago.

In the meantime, the U.S. population is constantly being inundated with so-called miracle cures promising “quick fixes,” usually through dietary supplements, the advice of diet books, or the latest fitness fad. Each provides the tempting lure of a “magic formula” that will help a person lose weight or gain health. The scientific evidence required to back up the claims made for these quick fixes is often lacking. Therefore, these quick fixes can, at best, be ineffective; at worst, they can be downright dangerous.

The temporary popularity of such quick fixes is a clear indication that many people hope to achieve a desired health or weight management goal through these methods. Since an instant cure is not the answer, what is an achievable solution for most individuals? It stands to reason that achieving and maintaining a healthy lifestyle through gradual changes and a lifetime commitment to balance, variety, and moderation in regular physical activity and healthful eating may be the key to success.

Making Changes that Last

Unlike people with heart disease, diabetes, and stroke, those with excess weight problems or low fitness levels are reminded of their affliction on a daily basis just by looking in a mirror. Just as for heart disease, diabetes, and stroke, however, overall lifestyle choices affect overweight and general health. One day, one meal, or even one trip to the gym is not the answer. Even though overweight, obese, and sedentary individuals are reminded of their condition daily, the process of behavior change is nevertheless complex and success is difficult to achieve.

Most health experts do agree that no one lifestyle factor is responsible for overweight and obesity. Instead, a complex combination of factors fuels this growing problem.

The principle of caloric balance is clearly applicable here. The foods that we eat, the frequency of eating, and portion size all contribute to the numbers of calories consumed. Some studies show that Americans consume more calories per day than they did 20 years ago. Perhaps the biggest change, however, has come in energy expenditures. Today, Americans are not only eating more calories and larger portions than ever before, but they have also become more inactive. There is a variety of reasons for this: decentralized community shopping centers, inadequate sidewalk systems, and long commutes all promote the use of automobiles and hence less physical activity. In addition, many people are spending more time than ever in front of the television or the computer.

The reasons underlying eating and activity behaviors are not well understood, but such behaviors are likely to be affected by the fast-paced nature of U.S. society. Consumers often report that they do not have the time to prepare meals and engage in regular physical activity. When it comes to the high-stress, complex lives that we are living today, the activities that must be done to achieve a healthy lifestyle often end up too far down on the priority list.

Small, Gradual Changes Over Time

To meet the goal of a healthy weight and lifestyle, consumers need to make changes to both sides of the energy equation: the inputs and the outputs. The desired approach is to incorporate small, achievable modifications in eating behaviors and additions of activity into daily life—activity that does not impinge on free time, and is enjoyable, and that can become habitual. The goal here is sustainability and balance.

WHAT'S NEW at IFIC Foundation On-Line?

Did you know that you can receive this publication by e-mail? All you need to do is go to <http://ific.org> and register. You'll receive e-mail notifications of new information in your areas of interest. All of our publications are available in both text and PDF formats. So don't delay; register today.

For those who have time constraints (which is most people), additional activity can occur in short, unobtrusive bursts. Walking the dog, parking further away than usual in the parking lot, strolling the mall, or getting off one subway stop earlier and walking the rest of the way all count as activity. If it helps, make a list of things you enjoy doing in your spare time, identify which can serve to increase your activity level, and then have fun doing them.

Likewise, healthy eating does not necessarily require a one-time dietary overhaul but requires small, practical, and sustainable changes. For instance, eating your meals more slowly to allow satiation to kick in, spreading out your meals throughout the day, and trimming portions a little bit at a time until the usual portion sizes are smaller than they were originally will help get you on the track to more balanced eating behavior.

Need More Information?

The IFIC Foundation has an ever-growing list of publications that describe ways that you can promote a healthy lifestyle. To order IFIC Foundation publications, simply visit the Web site at <http://ific.org/publications/>. The current list includes the following:

- i) *Helping Your Overweight Child* is an easy-to-understand booklet that gives guidance to parents and caregivers in identifying and assisting children with weight issues.
- ii) *Ten Tips for Healthy Eating and Activity for You* is a colorful brochure designed for 9- to 15-year-olds, with easy tips on balancing food choices (using the *Food Guide Pyramid*) and increasing physical activity.
- iii) *Ten Tips to Healthy Eating* is a brochure for adults, with quick tips on maintaining healthy weight, balancing food choices, and improving eating habits.
- iv) *The Benefits of Balance: Managing Fat in Your Diet* is a timely brochure showing how lower-fat foods—including reduced-fat, low-fat, and fat-free foods—can help you manage fat in your diet while continuing to enjoy your favorite foods.
- v) *Children's Nutrition and Physical Activity Teaching Set* is designed to help kids ages 9 to 15 understand the importance of combining nutrition and physical activity. The set features a 22"-by-34" two-sided poster highlighting the *Physical Activity Pyramid* alongside the *Food Guide Pyramid* (\$3.50 plus \$1.50 shipping).

The Bottom Line

New scientific evidence and public health initiatives continue to provide more information and direction on weight management and a healthy lifestyle. One thing is now certain, however: incorporating balance and moderation in both food and fitness is the best approach. It bears repeating—a healthy lifestyle requires a long-term commitment but the benefits are well worth it!

New IFIC Foundation Publications

Below are the newest releases from the IFIC Foundation. Single copies of most publications are available free-of-charge. For a comprehensive listing of publications or for bulk prices, please request the IFIC Foundation Publications List below.

- Publications List (MI-4010)**
A complete list of publications and *Food Insight* reprints available from the IFIC Foundation.
- The Low-Calorie Sweetener Tear-Pad (MI-4240)**
This four-color glossy tear-pad is designed for consumers to help answer the most commonly asked questions about the spectrum of low-calorie sweeteners and their role in a healthful diet. Each pad includes 25 tear sheets for use in consumer education. Please send ___ copies at \$5.00 each, plus \$1.50 shipping and handling. Enclosed is a check for \$____.
- Weight Loss: Finding A Weight Loss Program that Works for You (EB-2090)**
This helpful, easy-to-use brochure provides information and check lists for evaluating weight loss programs and services and helps consumers ask the right questions to choose a safe and effective weight loss method.
- Children's Nutrition and Physical Activity Teaching Set (MI-4200)**
A teaching set designed to help kids ages 9-15 understand the importance of combining nutrition and physical activity. The set features a 22"x34" two-sided color poster highlighting the Physical Activity Pyramid alongside the Food Guide Pyramid. Set includes the "Ten Tips to Healthy Eating and Physical Activity for You" brochure, reproducible slick, and poster. Please send ___ copies at \$3.50 and \$1.50 shipping and handling.
- IFIC Review: Low-Calorie Sweeteners and Health (IR-3025)**
This referenced white paper presents an overview of the currently approved sweeteners in the United States and those being considered by the FDA. The role of low calorie sweeteners in a healthful diet and in weight loss management is also discussed.
- IFIC Review: Understanding Food Allergy (IR-3070)**
This referenced white paper offers the latest scientific information on food allergy. It provides an overview on how to distinguish a food allergy from other sensitivities to food.

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Most Americans can Articulate Expected Benefits of Food Biotechnology

A survey conducted for the International Food Information Council (IFIC) found that most Americans (61percent) believe and can state how biotechnology will benefit them or their families in the next five years.

Consumers anticipate benefits including: improved health and nutrition (39 percent); improved quality, taste, and variety of foods (33 percent); reduced chemical and pesticide use on plants (21 percent); reduced cost of food (9 percent); and improved crops and crop yields (9 percent).

Support for these benefits is also seen in the total number of Americans (65 percent) who would be likely to purchase a variety of produce—such as tomatoes or potatoes—that has been modified through biotechnology to be protected from insect damage and require fewer pesticide applications. In addition, 52 percent of consumers are likely to purchase the same produce if it has been modified through biotechnology to “taste better or fresher.”

The ability to foresee and support benefits of biotechnology may be in large part related to the amount of information consumers are receiving concerning the issue. Consumer awareness remains stable, with 74 percent of respondents saying they have read or heard “a lot,” “some,” or “a little” about biotechnology.

The survey also found that 78 percent of consumers could not think of any information “not currently included on food labels” that they would like to see added and only 1 percent of consumers named “genetically altered” as an item they would like to see added to a food label. Additionally, 65 percent of consumers surveyed either support or do not oppose the Food and Drug Administration (FDA) policy on the labeling of foods produced through biotechnology; with a 2.5 to 1 ratio of people who “strongly support” the policy compared to those who “strongly oppose” it.

The survey was conducted in September 2001 by Cogent Research and is the sixth consumer survey on food biotechnology IFIC has commissioned since 1997. Approximately 1,000 telephone interviews were conducted among a nationally projectable sample of adults 18 and older in the continental United States.

Full survey results can be found on the IFIC Web site (<http://ific.org>).

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