

The Future of Nutrition: Consumers Engage with Science



Institute for the Future
New Consumer, New Genetics
Program



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ABOUT THE NEW CONSUMER, NEW GENETICS PROGRAM

The New Consumer, New Genetics (NCNG) program lies at the cusp of a revolution in the scientific understanding of the relationship between food and health. Three major forces are intersecting to drive this revolution:

- Fundamental **breakthroughs in genomics** and the life sciences are moving the scientific understanding of the connection between food and health to a deeper level.
- **Sophisticated consumers** are becoming more active in gathering and utilizing information they see as important to them.
- **New information about food and health** is changing the ways science, business, and consumers interact, and the intensity of that interaction.

During their yearlong membership, program members receive practical, incisive, and up-to-date analysis of emerging trends and likely consequences. A collaboration between the Institute for the Future's Strategic Planning and Health Care teams, NCNG offers an unparalleled opportunity for senior corporate planners and strategic thinkers from multiple industries to interact with NCNG colleagues, Institute for the Future researchers, and leading experts.

ABOUT THE INSTITUTE FOR THE FUTURE

Located at the northern edge of Silicon Valley in Menlo Park, California, the Institute for the Future is an independent, nonprofit research firm that specializes in long-term forecasting. We help organizations and companies identify and evaluate specific opportunities presented by market trends and new technologies. Founded in 1968, the Institute for the Future has become a leader in action-oriented research for business, industry, and government. Our clients include Fortune 500 companies, midsized and emerging companies, as well as government agencies and nonprofit organizations. We analyze policy, forecast alternative future scenarios, and identify markets for new products and next-generation technologies.

TABLE OF CONTENTS

LIST OF FIGURES	vii
LIST OF TABLES	ix
INTRODUCTION: ON THE CUSP OF A REVOLUTION	xi
Part 1	1
Science Brings New Choices	
CHAPTER 1	3
The Nutrigenomics Revolution	
Part 2	15
The Industry Moves Slowly	
CHAPTER 2	17
The Food Industry's Initial Response: Structural Barriers to Revolution	
Part 3	37
Consumers Will Drive the New Market	
CHAPTER 3	39
How Consumers Acquire Health and Nutrition Information	
CHAPTER 4	51
Sophisticated Consumers Are the Key	
CHAPTER 5	67
Consumers <i>Do</i> Change, Given Good Information	
CHAPTER 6	77
Information Flows Build the New Market	
Part 4	85
Forecasts and Strategies for the New Market	
CHAPTER 7	87
Forecast: Nutrigenomics and Consumers in 2010	
CHAPTER 8	101
Forecast: The Nutrigenomics Market in 2010	
CHAPTER 9	109
Strategies for Success in the Nutrigenomics Market	

LIST OF FIGURES

Figure 1-1	Nutrigenomics at the Intersection of Science and Consumers	8
Figure 1-2	Foods Ultimately Change Gene/Protein Expression	10
Figure 2-1	The Food Industry Supply Chain	18
Figure 2-2	The Food Retail Sector	20
Figure 2-3	The Redefined Supply Chain	22
Figure 2-4	Life Sciences Firms Acquired Seed Companies	23
Figure 2-5	Leveraging R&D	24
Figure 2-6	Access to New Distribution Channels	25
Figure 2-7	Combining Complementary Skills	26
Figure 2-8	The Top Four Food Retailers Dominate the Landscape	31
Figure 2-9	Rethinking the Life Sciences Firm	35
Figure 3-1	Nutrition Information Flows to Consumers Through Three Streams	46
Figure 4-1	New Consumers Form a Larger Share of Market	52
Figure 4-2	New Consumers Search Widely for Nutrition Information	53
Figure 4-3	New Consumers Likely to Always Read Nutrition Label	54
Figure 4-4	New Consumers Think Nutrition Labels Are Important for New Purchases	55
Figure 4-5	Traditional News Channels Used Less	56
Figure 4-6	Online Information Grows	56
Figure 4-7	New Consumers Lead the Media Shift	57
Figure 4-8	New Consumers Find Doctors Less Useful	58
Figure 4-9	New Consumers Find Medical Reference Books, Journals, and Newsletters Useful	60
Figure 4-10	New Consumers Find Popular Magazines and Books Useful	60
Figure 4-11	New Consumers More Likely to Use Health Web Sites	61
Figure 4-12	New Consumers Find Health Web Sites Useful	62
Figure 4-13	New Consumers Less Likely to Think Supermarkets Useful	64
Figure 5-1	Consumers Choosing Chicken Over Red Meat	69
Figure 5-2	Consumers Choosing Lower-Fat Milk Over Whole-Fat Milk	69
Figure 5-3	More Consumers See Vitamin Supplements as Necessary	70
Figure 5-4	Young Consumers Likely to Eat Outside the Home	72
Figure 5-5	New Consumers More Likely to Change Their Diets Proactively	73
Figure 5-6	New Consumers More Likely to Experiment with New Grocery Products	74
Figure 5-7	New Consumers More Likely to Try Organic Foods	77
Figure 5-8	New Consumers Use Supplements Daily	75
Figure 6-1	Nutrition Information Streams Today	81
Figure 6-2	New Consumers Get Information Directly from the Source in the Future	82

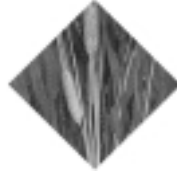
LIST OF FIGURES (CONTINUED)

Figure 7-1	The Consumer Nutrition Index	89
Figure 7-2	Information and Behavior Define the CNI	92
Figure 7-3	New Consumers Will Be Likely Responders	93
Figure 7-4	Users of Organic Products May Be Early Indicators of the Nutrigenomics Market	95
Figure 7-5	Age Provides Diversity	96
Figure 7-6	One-Third of Consumers in the Nutrigenomics Market in 2010	99
Figure 8-1	Focus on Food and Health Will Grow	107
Figure 9-1	Brand Manufacturers Link the Research with the Development	111
Figure 9-2	Experimental Shelves	115

LIST OF TABLES

Table	2-1	The Food Industry's Contribution to GDP, by Sector	19
Table	2-2	Seeds Were the Hot Property	23
Table	2-3	Life Sciences R&D Is Very High, Food R&D Is Lower	29
Table	2-4	Consolidation in the Retail Sector	31
Table	3-1	Consumers Want More Information than Doctors' Recommendations	41
Table	3-2	The Flow of Nutrition Information	44
Table	3-3	TV and Newspapers Capture Attention	45
Table	3-4	Consumers Use Many Sources to Get Nutrition Information	48
Table	5-1	Incremental Changes in Diet in the 1990s	71
Table	6-1	Consumer Guideposts	79
Table	7-1	CNI – Information	90
Table	7-2	CNI – Behavior	91
Table	8-1	Rapid Increase in Nutrition and Health During the Decade	108

INTRODUCTION: ON THE CUSP OF A REVOLUTION



The genomics revolution will forever transform the foods of the future and the ways they are produced and purchased. Specifically, advances in the emerging field of nutrigenomics promise a new understanding of the connections between food and human health at the molecular level. This new knowledge will give a growing number of sophisticated consumers the desire and know-how to mitigate or even prevent the onset of diseases to which they may be predisposed. In response, companies in the food industry will use this knowledge to produce and sell a whole new range of value-added products to an increasing share of consumers.

By 2010, we will come to know more about how particular foods interact with our genetic predispositions to such diseases as cancer, heart disease, and obesity—three of the major causes of death in the United States. Companies in the food industry will be able to leverage this knowledge by offering new foods—foods that will enable sophisticated consumers to increase their longevity and live healthier lives simply by changing and monitoring their diets.

By the end of the decade, modest adaptations of the foods we eat will have significant impacts on chronic health problems. Indeed, we will likely be able to alter our probabilities of getting certain diseases. Once consumers begin to get increasingly accurate and personalized information about the positive effects of such changes in nutrition, they will be motivated to change the way they think about the foods they eat and their reasons for doing so—not only to nourish, provide energy, and spend time with friends and family, but also to mitigate or prevent disease. While not every consumer will follow suit, this revolution will help whole groups of people understand the connection between food and their health.

The market niches created by these groups will become the crucial areas of opportunity for companies along the food supply chain. These companies can capitalize by bringing the benefits of nutrigenomics directly to consumers.

THE ROAD MAP

The road toward full marketplace acceptance of nutrigenomics-based food options is complex. In this report, *The Future of Nutrition: Consumers Engage with Science*, we discuss the issue in four parts:

Part 1 explores the revolution in science that is changing our understanding of the connections between food and health at the molecular level. This knowledge increases our ability to treat and prevent disease proactively by means of diet. In particular, we outline the key scientific advances we are likely to see in this area, many of them in the first half of the next decade.

Part 2 discusses how structural roadblocks in current R&D practices, intellectual property regulation, and retailing in the food industry may slow the pace of innovation. The food industry will make progress, but such progress is likely to be slowed by institutional boundaries and the way incentives are currently aligned.

Part 3 looks at the revolution from the consumers' viewpoint. It discusses what we know about consumers' current interests in nutrition. Indeed, some consumers already show a keen interest in nutrition issues and the connection between nutrition and health, and they utilize a

variety of traditional and nontraditional media for gathering information about these subjects. The most important cohort of consumers doing so is the large and growing group of sophisticated consumers—those with more education, higher incomes, and greater experience with information technologies—who are much more actively engaged in the search for information on a broad variety of consumer topics in general and nutrition information in particular. These sophisticated consumers delve deeply into information about nutrition—gathering it not just from more channels than other consumers but also from sources, like scientific journals, that are closer to the basic science.

Information-gathering activities are particularly important for us to monitor. Our surveys have found that the heavy users of information are much more likely to change their behaviors. Indeed, sophisticated consumers are likely to learn about, and want to experiment with, the products of nutrigenomics even before the food industry gives them many options in the marketplace. It is these consumers who will carry the nutrigenomics revolution—they will be the ones monitoring the results of research, inquiring about the availability of products, and finding the products that will help them.

In Part 4, we explore the consequences of this unique combination of the advancement of science and the demands of sophisticated consumers. Our first forecast, using current demographic, behavioral, and attitudinal data, is that about a third of the adult population in the United States will be ready to respond to the nutrigenomics market by 2010. Specifically, these consumers are likely to be willing to pay more to purchase nutrigenomics-based products and services. Next, we forecast the evolution of the market itself, and how the market will be divided into three sectors: existing foods, fortified foods and supplements, and genetically modified foods. Finally, we examine various strategies for success along the food supply chain, whereby firms can make sure they understand and develop a value-added position in the nutrigenomics market.

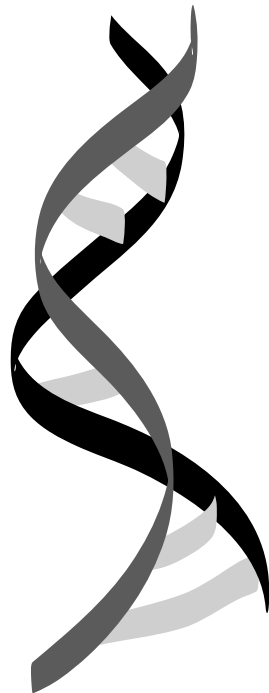
THE JOURNEY AWAITS

We live on the cusp of this new revolution. New opportunities are likely to transform the food market in the next decade. As a result, the food industry will begin to look more like other industries. It will move from today's world in which the dominant players leverage a low-margin, commodity business with ultra-efficient distribution systems and huge economies of scale to one with a growing number of smaller niches for value-added products and services meant for particular groups of consumers with similar health profiles. This transformation will be driven by the scientific advances in the field of nutrigenomics and the growing number of sophisticated consumers seeking out information about the connections between food and health. Those companies that learn most quickly about the potential of this new, consumer-driven market are likely to prosper.

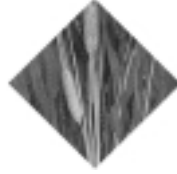
PART 1



Science Brings
New Choices



THE NUTRIGENOMICS REVOLUTION



A revolution in the life sciences is under way, with profound implications for the food industry. Indeed, rapid advances in the understanding of human genes are creating the new science of nutrigenomics—the study of the relationship between what we eat and how our genes function, and thus, ultimately, how healthy we are.

This new science is based on the combination of human genomics (the study of how genes function) and proteomics (the study of how proteins function). Together, these disciplines are developing much more detailed predictions of an individual's genetic propensity for certain diseases, as well as a deeper understanding of the role diet plays in suppressing or triggering these diseases. This revolution is coming on more quickly than anticipated—we expect to see major scientific advances as early as 2003.

This chapter serves as the road map of a journey ten years into the future, a journey toward a new understanding of the role of food in human health and of the players along the food supply chain in bringing about the revolution. As with all journeys, this one began long ago, in the transition from traditional to modern medicine and agriculture.



Nutrigenomics

is the study of the relationship between what we eat and how our genes function, and thus, ultimately, how healthy we are.

**THE NUTRIGENOMICS REVOLUTION:
FROM THE 16TH CENTURY TO THE PRESENT**

The nutrigenomics revolution will change the science of nutrition and thus create the conditions necessary for individuals to exert more control over their health by means of their diets. Four steps brought us to the verge of this revolution.

From Traditional to Modern Medicine and Agriculture

Microscopes for research, new surgical techniques, and the discovery of vaccines and antibiotics have marked the gradual progression from traditional to modern medicine over the last four centuries.

Along with these fundamental changes came more systematic medical research to understand the triggers that produce chronic disease. Clinical trials and large epidemiological studies were the prime means used to track causes of disease and efficacy of cures. The Framingham Heart Study, for example, has collected and analyzed data since 1948 on factors associated with cardiovascular disease from thousands of Framingham, Massachusetts, residents. According to the National Institutes of Health, Framingham researchers look for “common patterns related to [cardiovascular disease] development.” Once published, these patterns have provided doctors with clues to the causes of heart disease, including physical inactivity, high cholesterol levels, obesity, and diabetes.

The understanding of disease inheritance in humans also grew during the mid to late 20th century. Family history was combined with environment and lifestyle information to identify and treat high-risk patients with increasing specificity. Based on the results of epidemiological studies, researchers developed new drugs and diets to treat general populations exhibiting similar traits.

Agriculture underwent a similar shift from traditional to modern as the understanding of genetic inheritance in plants enabled more deliberate and specific hybridization and large breeding trials. These new varieties identified plants that could resist disease or respond to specific agricultural inputs.

But for both medicine and agriculture, these advances were made from the outside looking in, as it were. Epidemiological studies and

large clinical trials enabled researchers to test hypotheses about diet and health on large populations; similar large field trials in plant science enabled the generation of many new hybrids. These studies could not clearly identify the specific mechanisms through which genes affected human health at the level of the individual, however, nor the mechanisms through which genes affected plant and animal health and nutrient content. Understanding the dynamic interaction between specific diseases, individual genetic predispositions, and the metabolic pathways through which specific nutrients in plant and animal foods are processed by a single human body was the next step—from the inside looking out; that is, at the molecular level.

From Clinical and Field Trials to Understanding Genes

In the mid-20th century, many advances were made in the laboratory in understanding the basic building blocks of humans as well as other animals and plants. In 1953, the identification of the double helix structure of DNA by Francis Crick and James Watson in *Nature* allowed scientists to identify the genes of living organisms in cells in the lab. By the end of the century, the identification of gene sequences and the mechanisms of gene “expression”—that is, the detectable effect of a gene on the body—allowed experimental scientists to begin to track how and where genes are turned on and off, and their role and function in living cells and human disease. By 1983, the first disease gene was mapped in a laboratory, when scientists found a marker on human chromosome four for Huntington’s disease.

From the Laboratory to the Chip

In the 1970s and 1980s, the explosion of new information technologies, particularly high-speed supercomputers, began to intersect with life sciences in new and interesting ways. New techniques for sequencing genes using new computer-aided technology were developed. Today, genes are placed on microchips, greatly accelerating the speed of genetic sequencing. For example, Eos Biotechnology, using chips made by Affymetrix, has put snippets of 60,000 genes on two glass chips slightly larger than a nickel and promises to use a single chip by the end of the year.

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Today, genes are placed on microchips, greatly accelerating the speed of genetic sequencing.

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The goal of nutrigenomics is to predict the interactions of foods, namely micronutrients, in individuals, based on their unique molecular genetic profiles.

The Human Genome Project, an international endeavor by scientists to map the sequence of the human genome, was launched in 1990. By 2001, the full sequence was published, years earlier than anticipated—thanks to the new sequencing techniques. Later, Celera Genomics announced the sequencing of the mouse genome (which it chose to sell rather than publish), an important cornerstone for future research because of the widespread use of mice as test models in the laboratory.

Placing genes on chips has accelerated the process of genetically cataloging plants as well—to identify, for instance, those plants that may be good candidates for new drugs or simply have certain nutritional benefits. Plant scientists envision that within ten years the phenotypic expression of *Arabidopsis* genes, for example, will have been thoroughly studied by means of microchips. *Arabidopsis*, the lowly mustard plant, stands alone as the plant most studied by plant scientists, and because of its homologies with other plants, when a function is assigned to one of its genes, the function of the same gene will be known for many other plants. This comprehensive information about where and when every gene in the organism is expressed, its protein products, and the interactions of these proteins will allow researchers to map genes and their interactions more quickly, enabling their knowledge to be applied rapidly to other plants. In this way, scientists can potentially accelerate traditional processes for breeding new plants with greater nutritional or medicinal benefits, even without genetic modification.

From Genome Sequencing to Nutrigenomics

The past 40 years of advances in the human, animal, and agricultural sciences are finally paying off as they now enable scientists to understand and analyze the interactions of diet and genes and their relationship to diseases, such as cancer, at the molecular level. This has created the new field of nutritional genomics (nutrigenomics). The goal of nutrigenomics is to predict the interactions of foods, namely micronutrients, in individuals, based on their unique molecular genetic profiles.

Researchers at the Mayo Clinic, for example, recently found that the expression of genes that control androgen levels is inhibited by

quercetin, a natural flavonoid compound found in many plants, including apples and onions, and in plant-derived beverages, such as tea and red wine—an important discovery for men with advanced prostate cancer. Presenting their results at the American Association of Cancer Research annual meeting, researchers argued that, by blocking androgen activity, quercetin actually impedes the growth of prostate cancer cells.

Why is this revolutionary? An understanding of plant biochemical conversion processes coupled with the knowledge from the human genome of how humans metabolize foods will bring “prevention” to the center of medicine in the future, shifting the emphasis from health care per se to healthy living. At the same time, accelerated breeding and genetic modification—coupled with improved fortification techniques and improvements in the absorption of nutrients in products—will offer the potential for the quick development of food products in response to this shift.

Companies and institutions are already beginning to respond. For example, Myriad Proteomics, a newly formed genomics firm, recently announced a “three-year plan to identify all the proteins in the human body and show how these proteins interact to cause illness or promote health.” Furthermore, LifeSpring Nutrition was founded with the goal of serving “the nutrition needs of any consumer interested in health and wellness.” The American Heart Association also recently changed its national dietary guidelines for healthy adults to recognize the importance of advances in nutrigenomics, by adopting more general diet recommendations now with the specific intent to leave open the possibility for individualized nutrigenomics-based diets in the future.

THE ROAD AHEAD FOR NUTRIGENOMICS: CONSUMERS NEED INFORMATION

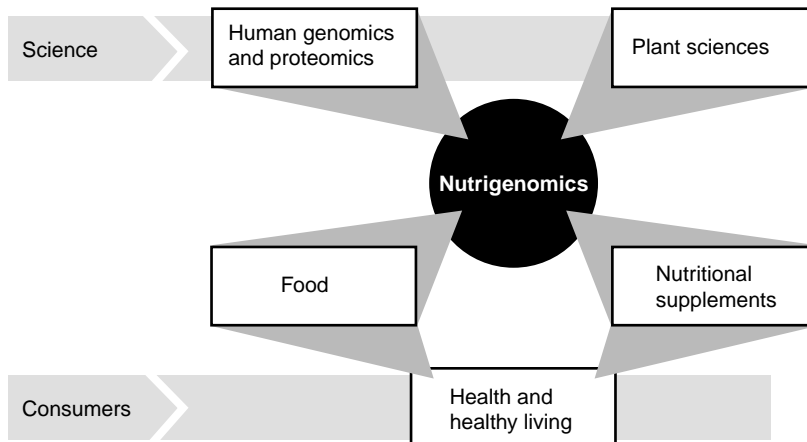
These are early responses, however, and there’s still a long way to go before nutrigenomic technologies reach the marketplace. For one thing, consumers need to learn about the technologies and what they can do for them; for another, consumers must be convinced they can trust the technologies. If effective methods for disseminating the flood of new scientific information to consumers are developed, and

regulatory agencies and players along the food chain earn and maintain consumer trust, American consumers will soon have enough information to exert more effective control over their health by their choices of foods and medicines (see Figure 1–1). With more knowledge of their genetic sequences and, thus, their predispositions to disease, many more consumers will have the potential to become actively engaged in the process of disease prevention by the end of the decade. This will be the real revolution.

THE RUSH IS ON: DISCOVERIES 2001–2007

We are on the cusp of a revolution in which the extent of information relating diet to health is likely to grow rapidly. We expect to see a continuing flow of information from basic scientific studies over the next few years that track the connections between foods, phytochemicals (micronutrients, such as antioxidants, commonly found

*Figure 1–1
Nutrigenomics at the Intersection of Science and Consumers*



Source: Institute for the Future

in fruits and vegetables that have important effects on gene expression), biochemical circuits, metabolism, and gene expression itself.

As a part of the New Consumer, New Genetics (NCNG) project, the Institute for the Future (IFTF) convened a workshop with experts in the fields of nutrition, biotechnology, food, and medicine; representatives from strategic planning groups within a variety of large companies who work in food, nutrition, and life sciences; and key representatives from health care and insurance organizations. This group explored the pacing and magnitude of the genomics revolution. We asked the members of the group to use their knowledge of current research to forecast likely examples of information that nutrigenomic science will make available to consumers over the next decade, and a timetable for such findings. They identified a number of advances that science is likely to support over the next few years.

2003: Testing to Complex Standards

By 2003, scientists will map 500 human genes that contribute to cardiovascular disease. Rather than concentrate on single genes, which are less reliable as predictors, scientists will examine how these 500 genes interact and respond to external stimuli as groups and subgroups. In each individual, these genes may combine differently to produce unique ways of responding to environmental factors. Understanding this combination, the set of genes and patterns of behavior, will be the valuable forecasting tool in the future and will provide the most reliable screening for risks of human heart disease.

2003: Combining Killer Genes on a Chip

Advances in tracking and identifying an individual's genes will create the opportunity to relate individual genetic makeup to a standard set of genetic possibilities. Technologies for individual genetic testing—or at least for typing into smaller subgroups with certain combinations of genetic predispositions—will make diagnoses of an individual's disease risks more affordable for hospitals and individuals. Scientists will also be able to combine the genes on faster and less expensive microchips for high-throughput screening. Cost savings will come in R&D, when rows of people at microscopes are replaced by a single chip.

2004: Identifying Precious Phytochemicals

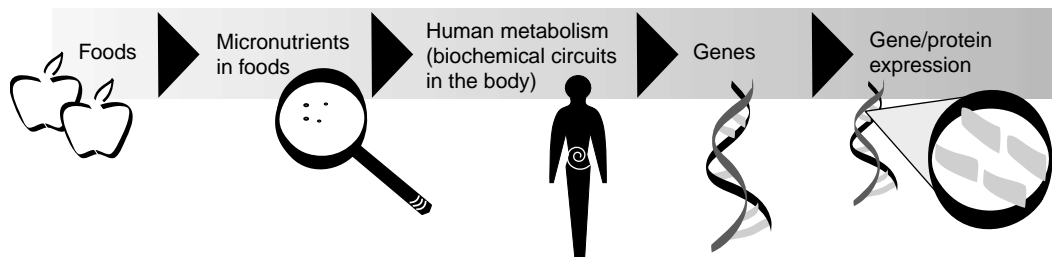
Phytochemicals are plant-based chemical compounds, namely the micronutrients found in all fruits and vegetables. Phytochemicals are beneficial in preventing disease in plants—and humans. It is possible for some of them to turn gene expressions on or off.

By 2004, scientists will identify at least 50 phytochemicals and map their pathways through the body. Examples of phytochemicals include lycopene in tomatoes and antioxidants in carrots and oranges. The genomics revolution will allow scientists to understand how these and other phytochemicals interact with biochemical circuits to influence the expression of specific genes and proteins in the body. Scientists will understand how these micronutrients in plants affect human health, which biochemical circuits and pathways they travel in the body, and the way they interact with human genes and proteins (see Figure 1–2). Such findings will provide scientists, physicians, and consumers alike a much richer understanding of which foods could be used to treat or prevent particular diseases.

2004: Understanding Overeaters

By 2004, the genes that control human appetite and the feeling of being “full” after a meal—the satiety genes—will be mapped. Scientists can then help people by increasing the understanding of human weight man-

Figure 1–2
Foods Ultimately Change Gene/Protein Expression



Source: Institute for the Future

agement. Understanding the biochemical circuits for satiety will revolutionize the diet and weight loss industries in the United States, in particular through the understanding of human genetic responses to food.

2005: Assessing Environmental Impacts

By 2005, complex interactions of environmental factors with biochemical circuits will be identified. By means of gene-environment profiling—or genetic profiling utilizing both genetic and environmental indicators—scientists will be able to assess with unparalleled reliability the impact of environmental factors on human metabolism and gene expression. Whereas epidemiological studies provided some of this information with only limited accuracy in the past, gene-environment profiling will allow scientists in laboratories to determine how various environmental factors, namely air- and waste-borne chemicals and the components of food products, affect the propensity toward disease. This helps them understand what triggers important changes inside living organisms. Combined with the knowledge of a multitude of disease genes and phytochemicals, the knowledge about environmental triggers will increase the precision of nutritional science sharply, particularly dietary recommendations for population groups with specific genetic variances and, ultimately, for individuals as well.

2007: Predicting Individual Responses

By 2007, using gene-mapping technology (such as the mapping of the 500 genes that diagnose cardiovascular disease), scientists will begin to predict individual, rather than group, human biochemical responses to foods—specifically micronutrients such as phytochemicals—based on a single individual’s genetic profile. Such prediction eventually will allow for individualized therapies and disease prevention based on natural foods, supplements, and fortified products. Whereas gene-mapping technology will be used in 2003 to predict predisposition to disease, by 2007 this technology will be used to provide increasingly personalized diets, based on the nutrients needed by an individual and his or her specific rates of absorption.

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Science is heading toward a new understanding of nutrition, one in which disease prevention is the primary goal.

IMPLICATIONS FOR 2008 AND BEYOND

These advances indicate that science is heading toward a new understanding of nutrition, one in which disease prevention is the primary goal. Just as the completion of the sequencing of the human genome occurred five years earlier than expected, the full integration of nutrition and genomics—personalized diets and tailored food—will also arrive early.

Tailored Food

By late in this decade, consumers will experience a much wider range of nutrition options. For example, today consumers can choose from three varieties of orange juice: “regular,” “organic,” and vitamin C- or calcium-fortified. But in five to ten years, orange juice may be fortified or genetically modified to include nutritional supplements that meet an entire range of special needs of a small segment of the population—juice will be preordered and prepared for the individual’s weekly store trip. Furthermore, consumers will know the five other products besides orange juice that provide the particular nutrients best for them, allowing them to diversify their diets without skipping important nutrients. With this increasing range of options, consumers will be able to live healthier lives while enjoying a wider range of choices.

Consumers in developing countries may also benefit from nutrigenomics. With the engineering of essential nutrients into rice produced for Gabon, for example—say, specific phytochemicals that fight against local parasites—as well as the production of edible vaccines, better nutrition is likely to become more widespread.

Plant genomics will help the world’s food industries meet basic human needs. Accelerated breeding or genetic modification to improve nutrition may become a community-based option that enables local farmers to “nutrify” their products before they are sold in local communities or other cities in the developing world. In order to feed the world, R&D in both developed and developing nations may focus increasingly on such modifications of staple foods.

Testing for the Masses

In the past, in order to predict propensity for disease, doctors looked to an individual's family history. There currently exist, however, new genetic blood tests for breast cancer, for example. In the future, such tests will be increasingly accurate and specific, able to predict an individual's propensity for an array of diseases by using a single blood sample. By 2010, there may well be information devices in the wealthiest U.S. households that will do the blood work at home to identify the genetic compositions and disease predispositions of individuals. These consumers could then use this information on their own or transmit this data directly to doctors, who can analyze the blood samples and recommend particular nutrigenomic strategies. Or the information could be passed from the consumer to a whole range of trusted agents—including his or her nutritionist, pharmacist, health or fitness club, chiropractor, or grocery store—for further analysis and recommendations.

2010: THE NEW NUTRITIONAL GOLD STANDARD

Whereas science currently enables consumers to see their diets mainly in terms of macronutrients—proteins, carbohydrates, and fats—diets in 2010 may be based increasingly on micronutrient or phytochemical content. Rather than saying, “This food is good for me because it has few calories,” one might find the information-empowered consumer of 2010 arguing, “I should eat this food with B₁₂ because, based on my genetic profile, my body can use B₁₂ to turn off the expression of my GSA7 gene, which causes hypercholesterolemia (excess cholesterol in the blood).” With information about the interactions between nutrients in foods, personal metabolism, and genetic profiles, educated consumers will be well equipped to make personalized nutrition decisions.

Personalized diets will be available on two scales. First, by mid-decade, expect to see personalized diets based on genetic common population polymorphisms (CPPs). CPPs are groups of individuals, greater than 1% of the population, who share similar genetic variances and, thus, similar responses to external stimuli—in this case, nutrients and foods. Genetic profiling and databases may divide people into

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By 2010, information devices in the wealthiest U.S. households will do blood work at home to identify the genetic compositions and disease predispositions of individuals.

different groups based on these common molecular responses to different nutrients.

Later, diets will become increasingly individualized based on single nucleotide polymorphisms (SNPs)—genetic variations held by less than 1% of a population. Individuals by themselves or working with trusted agents, such as doctors, nutritionists, and other health professionals, could log onto databases, like GenBank, and be able to find individualized diet recommendations to match their genetic profiles.

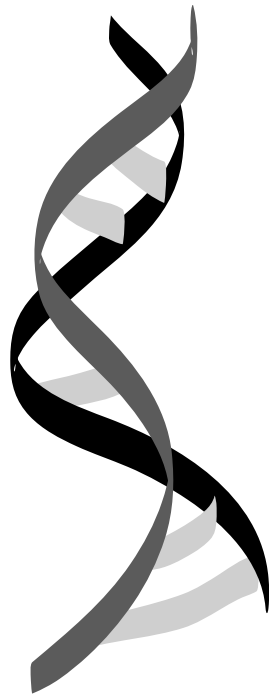
Although nutritional genomics and proteomics may ultimately lead to truly personalized diets after the end of the decade, scientists forecast that the crucial advances necessary in science will occur much sooner—as early as 2003. These advances will bring the revolution in nutrigenomics closer to the consumer, faster.

The bottom line is, the possibilities of such personalized diets—whether or not they are achieved through genetic modification—will ripple through the food, health care, biotech, pharmaceutical, agricultural, and grocery manufacturing and retailing industries in short order, with dramatic strategic implications. These industries will need to find ways to capitalize on the critical advances in nutrigenomics, creating new products and new choices for consumers. Are these industries ready for such vast changes? In the next chapter, we analyze the food industry players and the barriers that might arise in channeling nutrigenomics to the consumer marketplace.

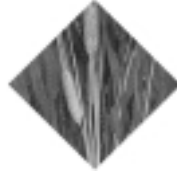
PART 2



The Industry
Moves Slowly



THE FOOD INDUSTRY'S INITIAL RESPONSE: STRUCTURAL BARRIERS TO REVOLUTION

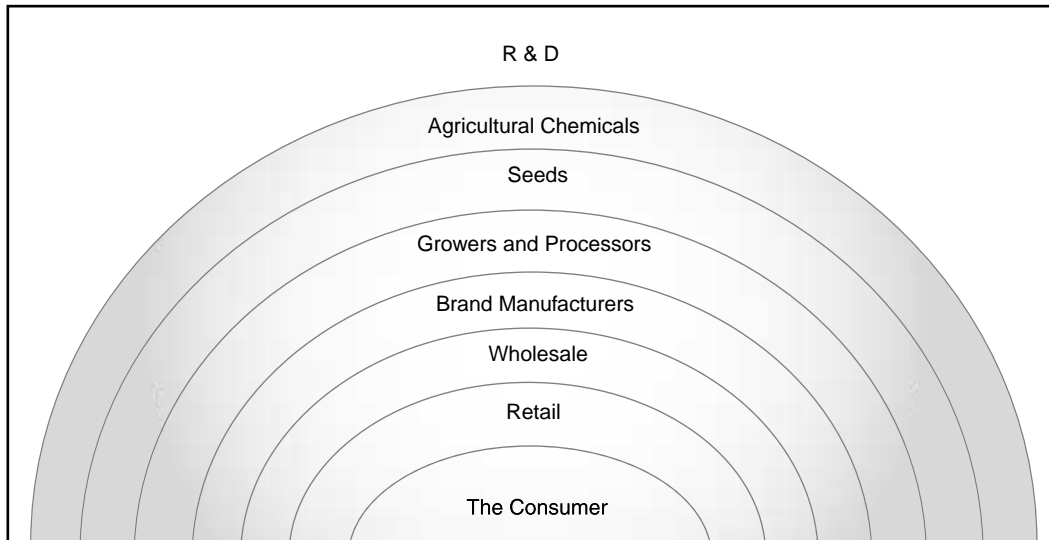


The genomics revolution and its possibilities for transforming the food supply chain have introduced new players to the marketplace, spurred the development of nutritionally enhanced products, and created a flurry of mergers and acquisitions as companies jockey for position. These efforts have met with only mixed success, however, in part because of strategic miscalculations by the players themselves, but primarily because the current marketplace poses structural barriers to the adoption of nutrigenomics-based products. For the nutrigenomics revolution to make its way from the lab through the food industry and to the consumer, such structural barriers must be overcome. Indeed, the food supply chain itself must be redefined, intellectual property protections clarified, and the value proposition fully communicated to consumers.

THE FOOD SUPPLY CHAIN

As science develops an increasingly personal link between nutrition and health, food has the potential to be transformed from a mass-marketed commodity with profit driven by low margins on high volume to a value-added, highly differentiated product with niche markets. The major food manufacturers have not overlooked this potential, and many significant players invested heavily in R&D to introduce new products based on the growing interest in nutrition and the evolving wealth of information on health and nutrition. There has been some success in this market—with organic foods and dietary supplements, for example, and with other foods marketed with specific health benefits, such as orange juice fortified with calcium. But there have been many more failures. For example, Kellogg's has discontinued a

Figure 2-1
The Food Industry Supply Chain



Source: Institute for the Future; U.S. Census Bureau; U.S. Department of Agriculture, Economic Research Service.

line of functional foods (foods that have been fortified for enhanced nutritional benefits), and Johnson & Johnson has been disappointed with the lack of interest in Benecol, a margarine that can lower cholesterol levels.

What is holding back innovation and experimentation along the food supply chain? To determine these factors, the supply chain itself must be understood.

Size and Scale

Here, we sketch out a stylized view of the food supply chain to establish a framework from which to discuss the transformative changes taking place in the food industry (see Figure 2–1). The traditional food supply chain begins with research and the basic inputs to the farmers—seeds and agricultural chemicals to prepare fields, stimulate crops, and inhibit weeds. Once the farmers have grown and harvested the crops, processors prepare them for use, and brand manufacturers develop a range of packaged goods for consumers. Wholesalers play a key role in moving the goods to retail stores as needed. In the last step of the chain, the consumer browses, shops, and purchases the food from the retailers. In sum, the growers, brand manufacturers, wholesale, and retail sectors make roughly equal contributions to GDP (see Table 2–1).

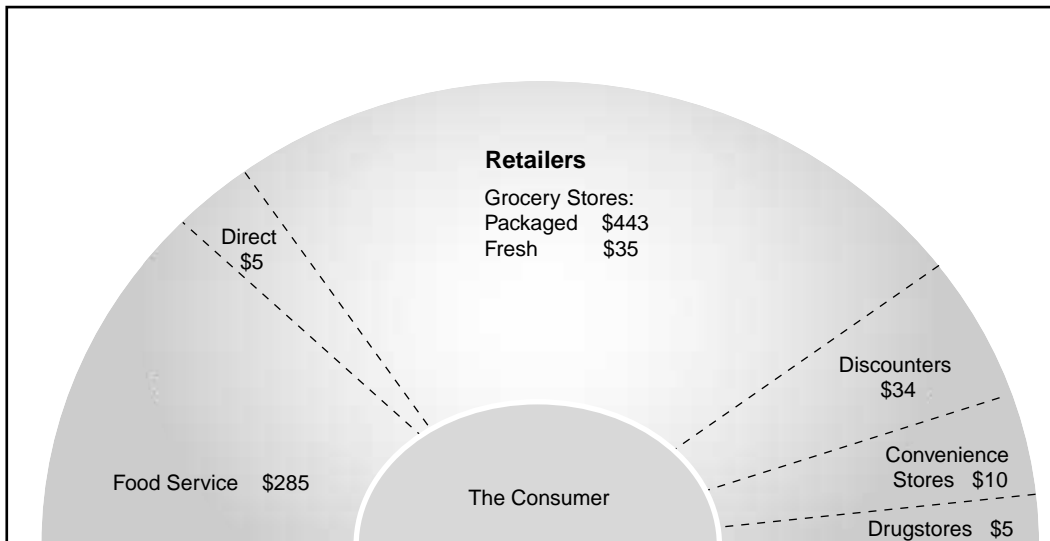
Table 2–1
The Food Industry's Contribution to GDP, by Sector
(Billions of dollars)

R&D	8
Agricultural chemicals	28
Seeds	3
Growers and producers	132
Brand manufacturers	122
Wholesale	80
Retail	109

Source: Bureau of Economic Analysis, National Accounts.

Of course, in each band of the traditional supply chain, numerous players are operating. For example, if we take a closer look at the retail sector for food, there are many more players than just the traditional grocery store. Characterized by intense competition and razor-thin margins, the food retail sector has been particularly dynamic over the past few decades. Whereas grocery stores are responsible for about half of all food sales, the food service industry, including restaurants, schools, and other sources of food away from the home, has grown quickly and now represents about 35% of sales. The direct-to-consumer channel, which includes farm stands and remote shopping, although still very small, has carved a \$5 billion niche out of total sales. And discounters like Sam's Club, Costco, and BJ's have also increased their presence in the market (see Figure 2–2). Food retailers leverage the

Figure 2–2
The Food Retail Sector
(Total sales by sector)



Source: Institute for the Future; U.S. Statistical Abstract.

knowledge gained from their close relationship with the consumer to exert power over the rest of the supply chain, which serves further to increase competition in the sector.

Repositioning in the Redefined Landscape

Participants in the food industry, from agricultural chemical firms through food processors or packagers to the retail market, have begun to adapt to the changes. The second half of the 1990s saw a flurry of mergers, acquisitions, and licensing activity, as companies repositioned themselves in the emerging life sciences industry. Eager to leverage their expensive R&D, gain access to new distribution channels, combine complementary skills, and streamline the licensing process, players throughout the food supply chain experimented with new configurations. Let's look at some of the major shifts that have taken place over the last five years.

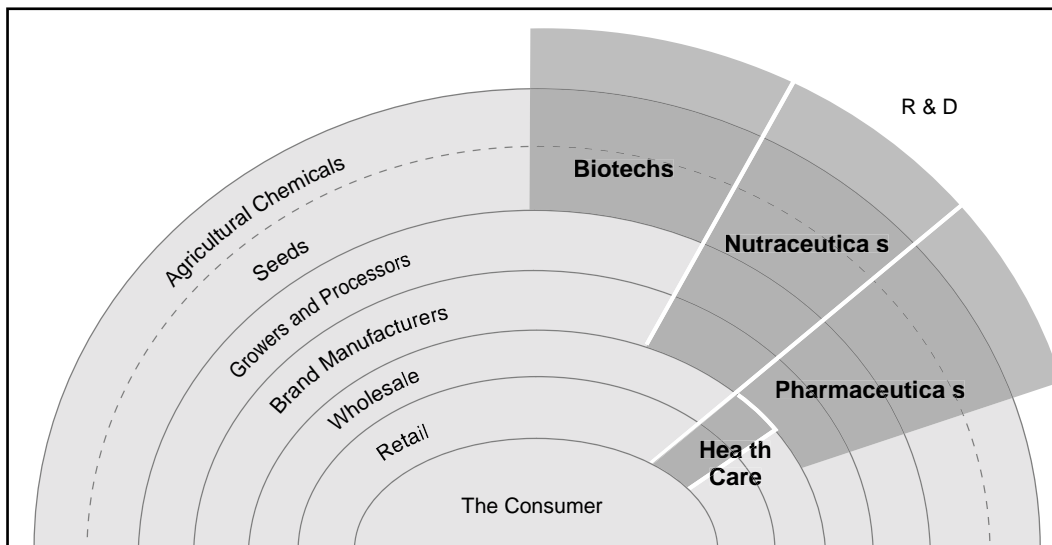
New Players Participating in Nutraceuticals

Over the last decade, the nutraceuticals market (foods, minerals, herbs, or dietary supplements that have medical or pharmaceutical effects) grew rapidly and totals over \$40 billion today. As biotechnology made it easier to tailor and target food and nutrition products, nontraditional players took a close interest in the food industry. Pharmaceutical and biotechnology firms entered the scene, eager to capture synergies from their scientific research and apply them to new foods or food supplements. They introduced a new line of products that blur the boundaries between food and medicine. These new players have begun to redefine the traditional food industry and emphasize the role of scientific research in food development (see Figure 2–3 on page 22). This phenomenon foreshadows the types of changes in the food supply chain that may be driven by the nutrigenomics revolution.

Seeds: Sowing the Intellectual Property

During the late 1990s, the rush was on in the agricultural world to capture control of the seed, the main means for distributing genetic changes, and the vessel of the industry's intellectual property. Between 1995 and 1998, large life sciences firms acquired 68 seed companies, significantly increasing the concentration in the seed industry (see Table 2-2 and Figure 2-4).

Figure 2-3
The Redefined Supply Chain



Source: Institute for the Future

*Table 2-2
Seeds Were the Hot Property
(Seed company acquisitions by life sciences firms, 1995-1998)*

Agricultural Chemical Companies

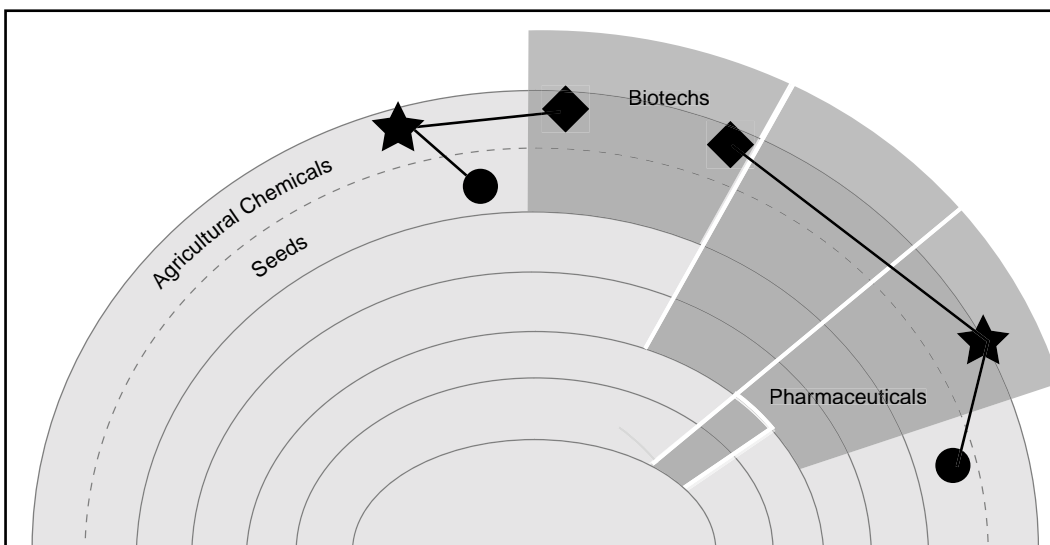
Monsanto	22
Dow	10
DuPont	5

Pharmaceuticals

Aventis	18
AstraZeneca	7
Novartis	6

Source: U.S. Department of Agriculture, Economic Research Service, March 2001.

*Figure 2-4
Life Sciences Firms Acquired Seed Companies*

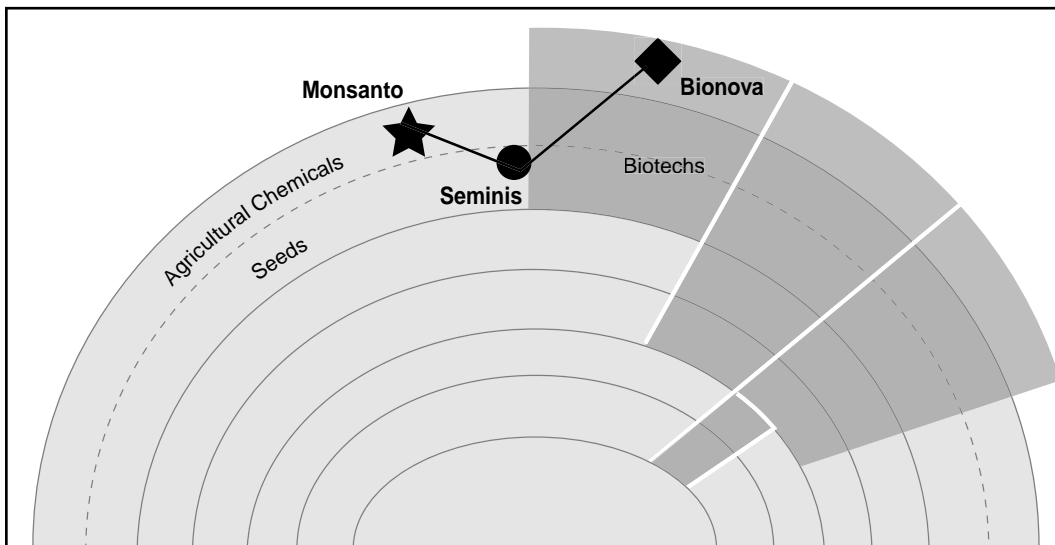


Source: Institute for the Future

Leveraging Expensive Research and Development Findings

Many of the biotechnology findings have applications in various arenas. For example, technology that benefits corn production may very well benefit production of other plants. Indeed, many of the discoveries are processes and technologies that *enable* further commercial discoveries. As such, many companies are leveraging their R&D resources by licensing their findings to other companies. For example, Monsanto, which concentrates on agronomic crops like corn and soybeans, licenses its technologies and innovations to Seminis, a vegetable seed company (see Figure 2–5). Seminis in turn has hired a biotech firm, Bionova, to develop vegetable seeds from Monsanto's research. (Seminis owns any seeds Bionova comes up with, although it pays royalties to the biotech firm.) Monsanto receives the benefits of its research through its own seeds, and also receives licensing royalties from Seminis. In this way, players in the new industry are becoming increasingly interdependent.

Figure 2–5
Leveraging R&D

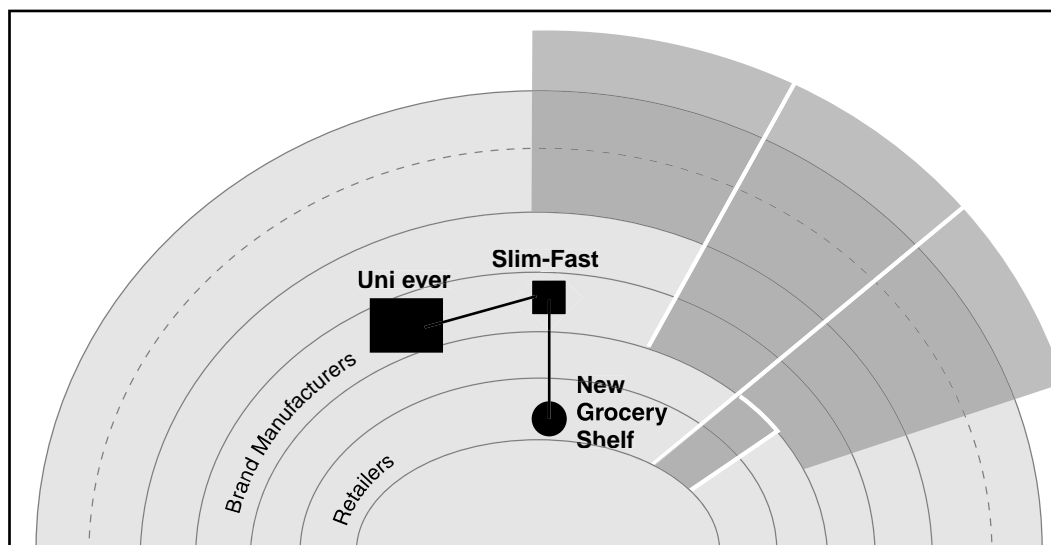


Source: Institute for the Future

Creating New Distribution Channels

Recognizing that the most successful new food players will be those that can enhance an existing popular product, many brand manufacturers are acquiring companies to access new distribution channels for their research findings. For example, Unilever recently purchased Slim-Fast, a popular weight management system (see Figure 2–6). Using this core of successful products, Unilever now has a new distribution channel located in a different section of the grocery store with very strong appeal to a certain segment of the population. If Unilever's R&D develops a new additive that aids in memory, for example, it can easily develop Slim-Fast "memory" bars and shakes. The flexibility and diversity that new distribution channels offer can be key for companies looking to succeed in the new world of food.

Figure 2–6
Access to New Distribution Channels



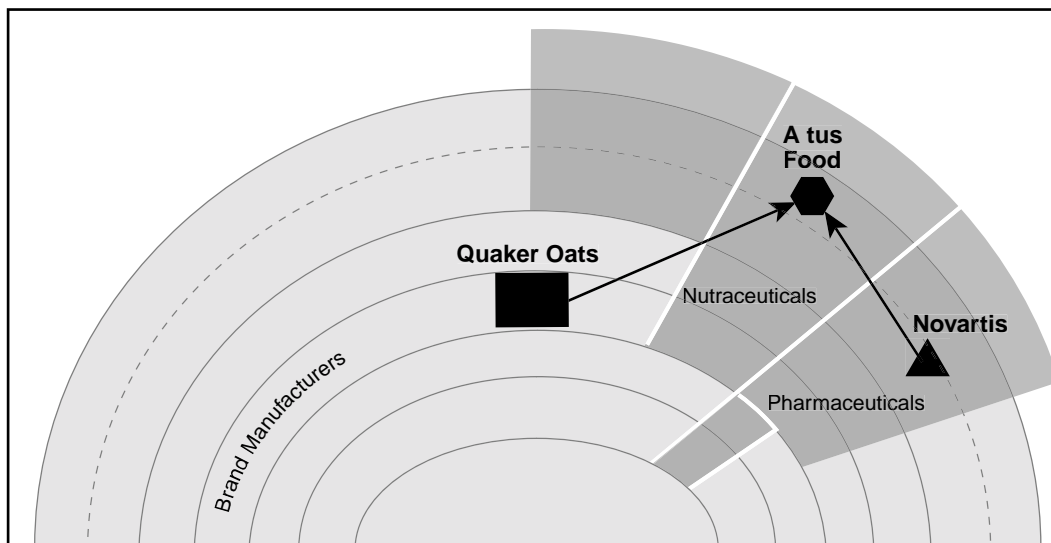
Source: Institute for the Future

Combining Complementary Skills

Nutrigenomics-based food products that are safe and grounded in science require a diverse set of expertise to bring them to the market. Pharmaceutical companies (with their research experience and strong cash positions) and food manufacturers (with their knowledge of food marketing and the consumer) may be natural partners for success in this new world.

In 2000, Novartis, a large pharmaceutical company, and Quaker Oats, an innovative food manufacturer, formed a joint-venture nutraceutical firm called Altus Food (see Figure 2–7). While the success of this venture is yet to be determined, Altus has outlined plans to develop functional foods and beverages that are scientifically proven to offer health benefits that surpass basic nutrition.

Figure 2–7
Combining Complementary Skills



Source: Institute for the Future

BARRIERS TO INNOVATION

Despite the activities of companies in the food industry to meet the potential of the scientific revolution, there remain several problems that inhibit their capacity to change rapidly enough to keep up with nutrigenomic science. The three biggest challenges are intellectual property issues, R&D, and the role of a consolidating retail sector.

Intellectual Property

Research-intensive industries produce goods that embody technical innovation, which in turn drive change in downstream product markets. Companies in industries like microprocessors, medical devices, and satellite communications components produce highly differentiated inputs protected by strong intellectual property rights. Patent rights that provide up to 20 years of protection for useful innovations in these areas foster increasing levels of investment through the venture capital and IPO markets and the stock exchanges that support the share trading of high-tech entrepreneurial firms. Pharmaceutical and life sciences companies—also industries with a strong intellectual property focus—have reaped large rewards during the high-tech boom of the past decade. Companies in more mature industries that provide a wide range of products to the final consumer, such as food manufacturers, and where intellectual property is not necessarily the key differentiation among new products, have not been rewarded nearly as well.

While biotechnology and genomics are beginning to provide a steady stream of inputs into the food supply, the incentives for innovation have been weak because of a traditional lack of protection. This is beginning to change at the level of basic inputs.

Inputs into the food supply chain historically have not been technically differentiated and thus have not received the level of patent protection afforded the inputs of other industries. In fact, prior to 1980, plant innovations were protected only by the relatively weak Plant Patent Act of 1930 and Plant Variety Protection Act of 1970. In 1980, however, the Supreme Court ruled that “anything under the sun that is made by man” can be patented, thereby reversing the rule that living organisms, even when genetically modified, were a natural phenomenon and,

as such, unable to be patented. This landmark decision opened the door for genetically modified plants, organisms, and animals to receive utility patents, the same protection afforded to new pharmaceuticals.

Due to the public sector's historically strong involvement in agricultural research, technology transfer from universities and federal research labs to industry has been imperative for getting new products into the market. The 1982 Bayh-Dole Act created an effective link between public research and commercial development, allowing universities to patent and license their innovations for use in the commercial sector. Outside universities, technology transfer was facilitated by the 1986 Federal Technology Transfer Act for Federal Research Agencies, which established Cooperative Research and Development Agreements (CRADAs). These CRADAs allow federal and nonfederal (including private) research groups to collaborate on research and share the results.

Although these rules strengthened the intellectual property structure in the market for base agriculture inputs, they had a smaller impact on the food processing and packaging industry, especially when it competes with the pharmaceutical industry for resources. In the case of a pharmaceutical company, high R&D costs eventually are recovered with the approval of a new drug, in the form of monopoly power for the length of the patent. The monopoly power is enhanced within the health care system by a doctor-controlled distribution system through prescriptions.

For a food, however, the margins are very slim; it is competing against existing foods, and any health claims are essentially a public good, so benefits must be shared by companies across a competitive industry. In addition, while a pharmaceutical company is selling only the efficacy of a particular drug, a food manufacturer marketing a product with a health claim must also sell the taste, convenience, and price of the new food product. The overwhelming value of a patent on pharmaceuticals vastly outperforms the returns on any innovation in the food industry. It is little wonder, then, that entrepreneurial firms working in genomics almost always define their goals in terms of pharmaceutical products.

Yet strong intellectual property protection can also be a barrier to the spread of innovation from the supplier industry down the food sup-

ply chain. Indeed, the sharp increase in patents covering genes, genetic engineering processes, and organisms has created new roadblocks for many companies trying to develop new products. For example, a team of university researchers developed a disease-resistant papaya for use in developing countries. In order to bring this product into a market outside the United States, the researchers had to negotiate six licenses with private firms. In another example, Dekalb's effort to sell Roundup Ready Corn required the company to bundle nine patents together, with five competing companies involved. The five companies holding the patents have since become two companies, the result of a series of mergers and acquisitions. Clearly, the path to the market has become increasingly complex and difficult to navigate.

Research and Development

As a result of these obstacles, the food industry has been slow in responding to the potential for developing new products. Although R&D spending in the life sciences is very high, and drug and pharmaceutical companies are spending a huge share of their total revenue on R&D, the food products industry has one of the lowest levels of R&D spending. Surprisingly, the amount of R&D conducted by companies in wholesale and retail trade is high, as firms investigate how to get products to the consumer more quickly and more efficiently (see Table 2-3).

Table 2-3
Life Sciences R&D Is Very High, Food R&D Is Lower
(R&D spending in 1997 as a share of total sales)

Drugs and medicines	10.5
Wholesale and retail trade	2.4
Other chemicals*	2.1
Food products	0.5

*This category excludes drugs and industrial chemicals, but includes agricultural chemicals.

Source: National Science Foundation, *Science & Engineering Indicators*.

R&D spending in the food products industry traditionally has been fairly low. In fact, this sector spent the smallest portion of total sales on R&D. Despite the small proportions, however, R&D in this sector is expanding. Food product R&D managers saw budget and staff increases in 1999 and 2000. In a 2000 survey by *Food Processing* magazine, 42% of respondents indicated a budget increase by an average of 15% between 1999 and 2000. In a 1999 survey, R&D managers reported a similar pattern of increases, although not as high as in 2000. The trend is headed in the right direction if food manufacturers want to participate actively in the nutrigenomics revolution. In the survey, R&D managers said that greater convenience and better health are at the forefront of the recent research efforts. R&D spending increases were strongest in nutritionally fortified foods, which is also one of the areas offering the most potential for growth.

Food manufacturers stress the importance of supplier relationships in healthy, productive R&D activities. The 1999 *Food Processing* survey found that 80% of R&D managers felt that suppliers were “the most important resource for the achievement of their R&D goals.” Working closely with suppliers allows R&D managers to leverage research dollars and streamline product development. This is a good thing. What isn't as good is that this pressure to develop products that will be successful in the marketplace right away discourages deep innovation, the type of innovation that will be needed to bring about the nutrigenomics revolution.

The large cost of developing new products increases the importance of clear intellectual property controls over those products, an issue that is getting more problematic in the redefined food arena. If innovation is to be encouraged in the food industry, there has to be a way for the innovative companies to recoup their R&D investment.

The Retail Sector

In addition to intellectual property constraints, innovation in the food industry is inhibited by another key factor—the increasing concentration of the retail sector into relatively few hands (see Table 2-4 and Figure 2-8). The retail sector has been through a period of significant consolidation, where the top four grocery chains—Kroger, Albertson's,

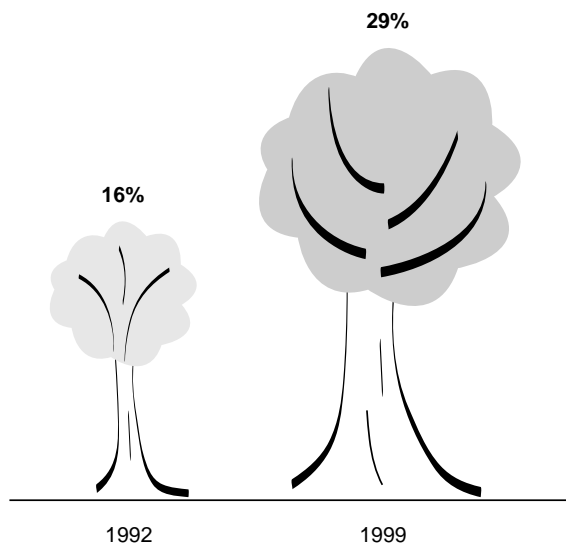
The Food Industry's Initial Response: Structural Barriers to Revolution

Table 2–4
Consolidation in the Retail Sector
(Market share nationwide of ... food retailers)

	<i>Top 4</i>	<i>Top 8</i>	<i>Top 20</i>
1992	16	25	37
1999	29	39	51

Source: U.S. Department of Agriculture

Figure 2–8
The Top Four Food Retailers Dominate the Landscape
(Market share nationwide of top 4 food retailers)



Source: U.S. Department of Agriculture

Safeway, and Wal-Mart—now capture almost 30% of the market, and the top 20, more than half of the market. Virtually all of these stores are large enterprises with excellent standards of services, a wide range of products (often more than 50,000 SKUs), and very competitive prices. Retailers have developed sophisticated technology to drive down inventory costs, by ensuring that products in demand are always on the shelf but move off the shelf quickly. Competition for space on the shelf has intensified, and tolerance for slow-selling items is low.

The retail sector has a great effect on the food industry as a whole. Retailers control a vast amount of consumer data, based on general inventory scanning and the more personal loyalty cards. Using these data, the retailer tracks evolving consumer preferences, which it then uses to exert pressure on the brand manufacturers and to pass some of the marketing and distribution costs back to the product manufacturer. The largest retailers represent the consumer interest by keeping product prices low. By using their enormous purchasing clout, these large retailers can exert pressure to keep prices down while they make decent profits by selling large volumes of low-margin items. Since they make their profit on volume, these large grocery companies have very similar formats in every neighborhood—their goal is to use their standard products to reach 80% of the market. The very efficiencies that they have brought to the market—efficient distribution, bulk purchasing of standard items, common formats, low inventories, freshness, and attractive packaging—don't allow much room for experimentation or innovation.

Mainstream grocery stores do keep an eye on alternative markets like Whole Foods and Wild Oats (which sell natural and organic foods) for successful products, but the qualifications for shelf space for new products that appeal to a limited range of customers at the grocery store are difficult to achieve. New products usually require extensive marketing agreements and the promise of a sizable, proven customer base. The current system does not allow much room for innovative products that may take some time to build a new loyal clientele from specific subgroups of the consumer population.

RETHINKING THE INTEGRATED LIFE SCIENCES

After the flurry of mergers and acquisitions in the late 1990s, life sciences firms ran into problems capitalizing on the potential synergies between food, drugs, and biotechnology. In essence, integrated life sciences firms have run into three problems in the marketplace: (1) incentives in the intellectual property system and the marketplace placed a much higher premium on drugs than food; (2) the stock market does not reward the potential R&D synergies between pharmaceuticals and food; and (3) the marketing clout of the large drug companies has no synergies with the food market because drug companies focus their distribution on doctors and the health care industry, as opposed to the consumer-marketing of the retail food industry. After investing so heavily in biotech research, life sciences firms found that it made sense to put that technology into drugs instead of food, especially considering food's notoriously slim margins.

The agricultural sector, already a low-margin commodity industry, experienced a market slump in the late 1990s. The functional food market didn't take off as predicted and large name brands like Kellogg's withdrew poorly performing products from the market. To top it off, consumers weren't as receptive to these new foods as companies thought they would be. Even worse, many consumers, especially in Europe, were unwilling to shoulder the perceived risks associated with genetically modified foods, and they started to put pressure on regulators and brand manufacturers to push back on genetically modified foods.

While R&D charges forward with scientific advances, Food and Drug Administration (FDA) regulations—which by design are slow to change—seem ill designed to handle the increasingly gray areas between foods and drugs. It is fairly easy to get permission from the FDA to distribute new food products to the public, yet strict regulations limit the health claims companies can make for their products. In a competitive market, however, once a new food product or ingredient is approved for making a particular claim, any other product that meets the same criteria can make the same claim. Consequently, food companies find difficulty justifying the enormous research costs necessary to prove to the FDA the validity of health claims.

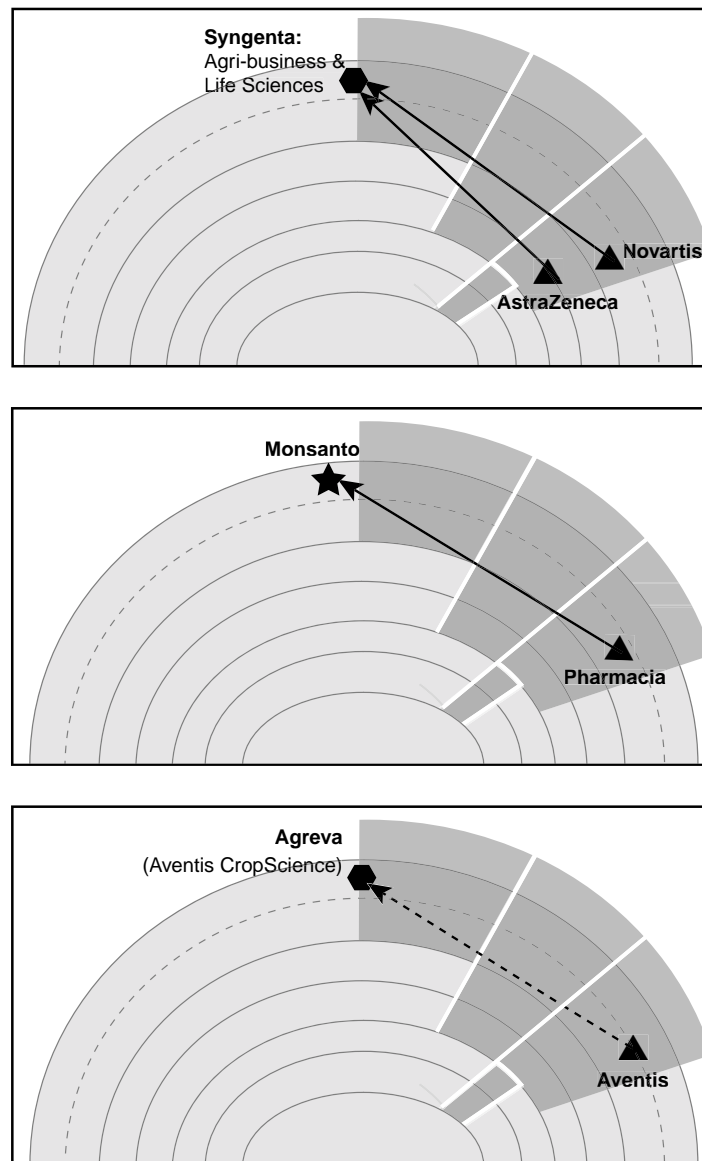
As a result of these initial disappointments in the marketplace, many life sciences firms decided they would be better off dissociating from the agricultural sector, and they began to divest their interests. Novartis and AstraZeneca spun off their agri-business sectors together to form Syngenta. Pharmacia detached itself from Monsanto to concentrate on pharmaceuticals, while Monsanto focused on agriculture. And Aventis is in the process of spinning off its Aventis CropScience unit to form Agreva (see Figure 2-9). These companies have retained their interest in nutraceuticals, but not agriculture.

CONCLUSION: BARRIERS TO INNOVATION STILL EXIST

The food industry has been trying to integrate two major developments of the past decade—the advances of the biotech revolution and the gradual emergence of the market for “healthier foods,” including organic foods, functional foods, and dietary supplements. But these adaptations have run into significant roadblocks. As mentioned previously, food has traditionally been a low-margin business. While farm productivity has increased, the cost of a wide range of foods has remained very low. Virtually all consumers can afford a wide spectrum of high-quality, convenient foods that taste good. Consumers are used to the fact that, as their incomes go up, they spend a smaller portion of their total income on food. So far they have shown that in general they aren't ready to pay a premium, even for foods that might make them healthier. On the industry side, food players have adapted well to the high-volume, low-margin business. Food packagers have emphasized marketing (very large ad budgets, a keen concentration on packaging and distribution, and emphasis on quality, known brands at reasonable costs). Retailers provide large volumes of standardized products in convenient settings with good service. Successful players have reinforced the structure of the market—a great distribution system for high-quality, low-cost, low-margin products with mass appeal.

Unfortunately, this system as it currently stands is not set up to support revolutionary innovation. The nutrigenomics revolution we described in Chapter 1 is antithetical to the traditional system. The revolution does not want a “democratic” industry with everyone sharing the same set of products. Rather, the nutrigenomics revolution will suc-

Figure 2-9
Rethinking the Life Sciences Firm



Source: Institute for the Future

ceed only if it creates niches—at first, hundreds of diet variations, and, eventually, thousands. Some of these diets will be based on existing mass-market products, but others will consist of specialized products and supplements. It will take time for the industry to learn which revolutionary products will persuade consumers to pay a premium for customized foods.

Products that do make a difference will be valuable to consumers, and this added value will be reflected in the prices of the new foods. In the future, the food industry may look more like the department store or specialty store market—with very different stores, layouts, and products appealing to more narrowly defined groups. In fact, the industry will undergo adaptation until it eventually looks more like most other consumer sectors—apparel, furniture, automobiles, accessories, travel, and entertainment—with richer and more varied choices in every community, and higher overall margins.

It will be difficult to get there from here, however. Given the barriers we have identified—the low-cost, low-margin nature of the marketplace, the difficulty recouping R&D investments through intellectual property protection, and the consumers' lack of understanding of the value proposition—the industry is unlikely to change from within very quickly. Instead, the change will come only gradually, as stores accept new products in an incremental fashion, and consumers respond to these new choices case by case. Large-scale change will require flexibility and experimentation on the part of the entire industry—and time.

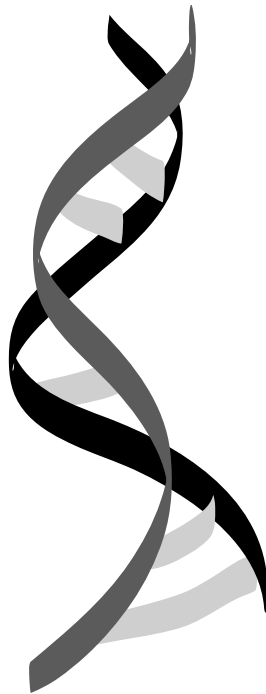
If the large-scale changes required to drive the nutrigenomics revolution aren't going to come from the industries themselves—food or health care—then they must come from somewhere else. As IFTF has discovered in its research, the most significant driving force in the global marketplace is the rise of sophisticated consumers, who have large disposable incomes, higher education, and experience with information technology. We call these the “new consumers.”

As new consumers transform the global marketplace, they will naturally also change food markets. Indeed, consumer demand is perhaps the only force that can bring about a revolution in a marketplace that is already enormously successful.

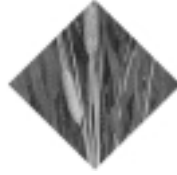
PART 3



**Consumers Will Drive
the New Market**



HOW CONSUMERS ACQUIRE HEALTH AND NUTRITION INFORMATION



The barriers to fundamental change in the food industry are huge. They weaken the impact of the nutrigenomics revolution on the nutrition choices available to consumers. But in an increasingly consumer-driven global economy, consumers may be able to use their growing determination to get what they want and their buying clout to transform the food industry—once they have access to the right information.

Once they get the right information—that’s the key. Understanding the way consumers acquire and use information is crucial to understanding how the nutrigenomics revolution is likely to unfold. We discuss this issue in the next four chapters.

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**“If we could
get information
to help us live
better ...”**

*—A 56-year-old
female consumer
explaining why she
likes the idea of adult
genetic testing*

CONSUMERS AND NUTRITION INFORMATION

Consumers are showing an increasing interest in information about health and nutrition and are coming to see this information as an important factor in controlling their diet.

A recent survey by the American Dietetic Association (ADA) found that most consumers (85%) feel that diet and nutrition are important to them personally. The ADA also found that 40% of respondents claim that they are either “very” or “somewhat” careful in selecting foods to achieve balanced nutrition and a healthy diet—up by six percentage points since 1997. In fact, when shopping, most consumers read nutrition labels on packaged foods.

It’s not just any information they look for. Consumers report being very interested in obtaining the most up-to-date information to manage their diet. The ADA found that almost half (43%) of Americans say they like to hear about new studies on diet and health.

Information Means Control

This interest in nutrition and diet is part of a larger consumer movement to gain control over their health. All in all, consumers want more input into their health care. Consumers report that they want more information about medical options, for example. And although they see doctors’ input as an important resource, they want control over decisions about their treatment as well (see Table 3–1).

In line with this trend toward taking greater responsibility for their own care, consumers have said they are willing to use new information—such as that from genetic testing—if it would help them get greater control of their health. Recent surveys by Yankelovich Partners and the *Los Angeles Times* found that 60 to 65% of respondents would be interested in taking tests that would reveal their genetic predispositions to disease, while only 24% of survey respondents reported being unlikely to take such a test. The respondents were interested primarily in getting more precise information about risks they already know about. About half (47%) of these consumers reported that they would take these tests because they have a family history of a disease and would like to find out more about their own or their childrens’ risks of that disease.

Our focus group participants clearly perceived benefits in information derived from such tests, and stressed that the information would be valuable if it identified preventable conditions. For example, one elderly male focus group participant explained: “If you could stop something way before it’s going to happen, then you’re not doing reactive—you’re doing preventive work.”

Several participants also made a connection between receiving this information and changing their diets; for example, an elderly female focus group participant said: “It would be helpful to know if you were predisposed to some kind of disease, say like Alzheimer’s or breast cancer. Then you would know to eat better or to eat certain foods that would enhance your health.”

For consumers, then, the benefit of adult genetic testing primarily lies in the ability to identify preventable conditions and to use that information to change their diet. In fact, several focus group participants indicated that they would be so interested in this type of information

Table 3–1

Consumers Want More Information than Doctors’ Recommendations

“Suppose you were seeing a medical specialist and needed treatment for a particular medical condition. Which of the following would YOU BE MOST LIKELY TO DO?”

<i>Option</i>	<i>Percent</i>
Let the doctor decide what treatment is best without involving me.	19
Look for information to understand my treatment options, but let the doctor decide what is best.	48
Look for information about treatment options so I can decide for myself what is best.	32

Source: Institute for the Future, NCNG Household Survey, 2001.

•••••

“I’d say if it had a lot of stuff in it—you know, diabetes, high blood pressure, and all this—I’d pay \$5,000 for that. I mean, that would affect the way I’d live my next 20 years. That’s a good investment.”

—A young male focus group participant on adult genetic testing

they would be willing to pay for the test themselves—typically \$100 or less, but occasionally more, depending on the detail of the results and the privacy of the information.

Privacy Concerns Are a Barrier to Sharing Information

Although consumers want more personalized information about their health, they are very concerned about the privacy of that information. The vast majority of U.S. residents have become increasingly concerned about their privacy over the past two decades. In a 1978 survey by Louis Harris & Associates, 64% of respondents were either “very concerned” or “concerned” about such threats; by the year 2000, our survey research found that over 80% expressed such fears. In such an atmosphere of heightened concern, consumers may express fears about making personal genetic information available to others. As one female new consumer said, “I think [personalized genetic information] would be very valuable to me—I mean, almost priceless really, to have it for myself. But I would not want to share it.” Consumers are the most concerned about sharing their genetic profiles with employers and health insurers, who could potentially discriminate against people with risky genetic profiles.

Although consumers’ privacy concerns should not be underestimated, we have found that consumers are likely to share their personal information with businesses if there are clear benefits for doing so. One of the most important benefits for consumers is the exchange of personal information for targeted services, advice, or products. For example, an IFTF survey in 2000 found that almost half (44%) of adults have given businesses personal information in exchange for regular updates on product information relevant to them (among those with at least some college education the percentage rose to about 60%). Another survey, conducted by the Personalization Consortium in March 2000, found that 51% of Web users were willing to share information “to receive an online experience truly personalized for me.” Consumers will be willing to share their genetic profiles with companies that can provide clear benefits for sharing, a secure way to share information, and a guarantee that the information will not be misused.

INFORMATION SOURCES

Consumers say they find information about health and nutrition useful. But how do they get good information, and how do they know they can trust it?

Information about food and nutrition is available to the consumer from a variety of sources. It is first generated in the science lab or field, and the results work their way to the consumer as they are applied to new products. The ideas and discoveries behind the products wend their way from conception to the general public through consumer media, industry advertising, and the health care system. At each point along the information flow, consumers have the opportunity to gather different types of information with different levels of detail.

Consumer Media

Information dissemination usually starts in the dense technical writings of scientific and medical journals. This information is repackaged for consumers' use by moving through a range of media, from more detailed and scientific to less detailed and descriptive.

The first level at which consumers are likely to encounter the information are reports in medicine- and science-oriented journals and Web sites, such as *Scientific American* or BioSource. These are closest in format to peer-reviewed scientific articles, but a little less technical for a consumer audience.

Next are media that offer regular, ongoing articles or sections dealing with health and nutrition, such as the *Washington Post* or the *Los Angeles Times*. The occasional feature stories in periodicals such as *Newsweek*, or on cable channels like the Discovery Channel, are less intensive sources of nutrition information. At the bottom of this flow are short, extremely simplified articles, such as brief local news reports or information from the Associated Press that appears in local newspapers. Table 3–2 (on page 44) shows how innovative nutrition information might flow to the consumer. Also, the number of readers and viewers goes up as the stories get simpler (see Table 3–3 on page 45).

Chapter 3
 How Consumers Acquire Health and Nutrition Information

*Table 3–2
 The Flow of Nutrition Information*

<i>Type</i>	<i>Publications</i>	<i>Web Sites</i>	<i>Other Media</i>
Technical articles in peer-reviewed journals	<i>Science, Nature, New England Journal of Medicine, American Journal of Clinical Nutrition</i>		
Reports in health and science publications and news reports	<i>Scientific American, Science News</i>	LifeScience, Genome Web, BioSource, Genome News Net	
Ongoing science and health features	<i>Washington Post, Los Angeles Times, Prevention, Cooking Light, Harvard or Johns Hopkins Health Letters</i>	WebMD	CBS Healthwatch
Occasional feature stories	<i>Time, Newsweek, Redbook</i>		TV features, Cable channels features
Occasional brief news coverage	Local newspapers, Associated Press, Reuters		Network and local TV news

Source: Institute for the Future

Table 3-3
TV and Newspapers Capture Attention
(Percent of households that use ... regularly for news on nutrition)

Scientific journals	<1
Specialized journals	4
Health/nutrition Web sites	8
News magazines	12
CNN cable news	21
Network news	30
TV features	31
Local newspapers	46
Local TV	56

Source: Institute for the Future; data derived from Pew Research Center, 2000, *Media Age*, *The World Almanac*, and journal subscription reports.

Other Information Sources

In contrast to consumer media, where innovative information boosts sales directly, other information sources have a less clear interest in providing revolutionary nutrition information. For example, although the health care system provides nutrition information, the incentives in that system are driven by the need to provide care for people who are ill. The key profit drivers in health care are patented pharmaceutical, not nutrition, products.

The food industry also provides nutrition information, of course, but it is a commodity-based system dominated by large players at the brand-packaging, distribution, and retail levels that provide a wide selection of products at relatively cheap prices in the mass market. Although some food industry players may indirectly influence consumer media through press releases, most food industry information goes to consumers in the form of marketing, about which many consumers are skeptical.

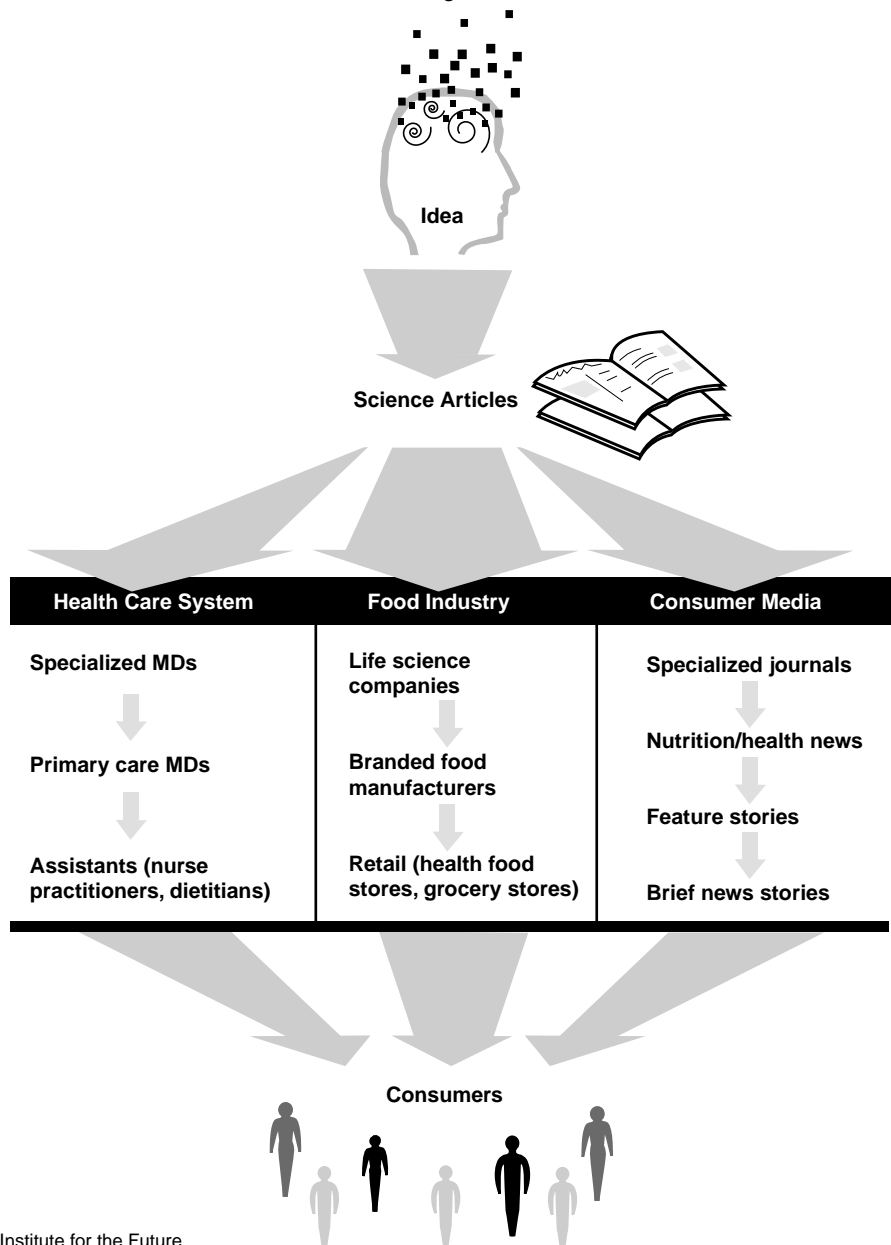
The flows of information from these sources might involve relatively fewer steps compared to flows in the popular media. Nonetheless, they are all at work at the same time. Consumer media, the food industry, and the health care system all provide nutrition information to consumers in essentially parallel streams (see Figure 3–1).

CONSUMERS USE WIDE RANGE OF SOURCES FOR NUTRITION INFORMATION

In order to determine which sources of information consumers use most often, we asked our household survey respondents to identify where they searched for information about nutrition within the past five years.

The responses indicate that consumers search for nutrition information from a variety of sources. The survey found that 63% of consumers looked for nutrition information within the last five years, with consumers looking at 4.4 different sources on average. Consumers are likely to obtain nutrition information from all three of the flows we identified, particularly from consumer media and the health care system (see Table 3–4 on page 48). Of course, this is not an exhaustive list of sources; for example, consumers also report getting nutrition information from other consumers, such as family and friends, and from health clubs and alternative health care providers, though these sources are used less frequently.

Figure 3-1
Nutrition Information Flows to Consumers Through Three Streams



Source: Institute for the Future

*Table 3–4
Consumers Use Many Sources to Get Nutrition Information*

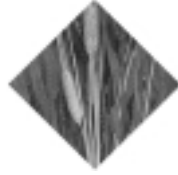
<i>Source</i>	<i>Percent</i>
Consumer Media	
Popular magazines or books	65
TV programs	45
Health Web sites for consumers	25
Health Care System	
Doctors	57
Medical reference books, journals, or newsletters	51
Assistants (e.g., nurses, nurse practitioners)	38
Food Industry	
Supermarket displays, brochures, or employees	36
Major brand food company advertisements or Web sites	30
Other Sources	
Friends and family members	62
Alternative medical practitioners such as chiropractors, herbalists, or acupuncturists	16
Health or fitness clubs	17

Source: Institute for the Future, NCNG Household Survey, 2001.

**CONCLUSION: CONSUMERS SEEK OUT AND USE HEALTH
AND NUTRITION INFORMATION**

Consumers show an increasing interest in using information about health and nutrition as an important element in controlling their diet. This information comes to consumers from a variety of sources, generated first in a science lab or in the field and then working its way through the flows of media, food industry advertising, and the health care system. Since consumers are likely to obtain nutrition information from all of these flows, anyone who wants to inform consumers of changes such as those about to be brought on by the nutrigenomics revolution ought to be well versed in communicating with consumers through these channels.

SOPHISTICATED CONSUMERS ARE THE KEY



Although the sizable flow of information about health and nutrition could be disconcerting to some people, a large and growing group of consumers is finding it extremely valuable. These sophisticated information users have found new ways of using large amounts of information to make their own purchasing decisions. Empowered and discerning, these new consumers, as we call them, want what they want when they want it, and find that better information helps them get what they want.

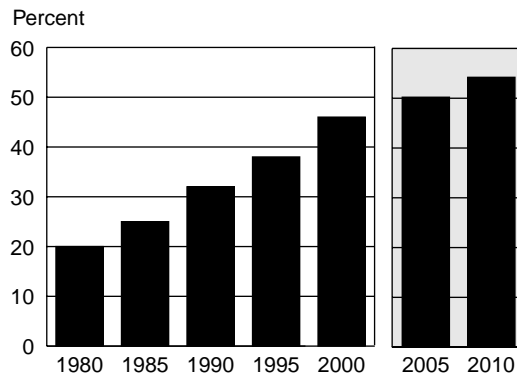
Characterized by high discretionary income, good education, experience with information technology, and the ability to find and analyze information from a range of sources, new consumers prefer to have control over their interactions with businesses, and thus seek interactive communications with businesses so they can get information and services exactly the way they like them. In our research, we define individuals as new consumers if they possess at least two of the following three characteristics: \$50,000+ annual household income, PC ownership, and at least one year of college education. In the following chapters, we depict new consumers by education level. Income level and PC ownership data show similar trends.

New consumers now make up close to half the adult population of the United States, and IFTF researchers forecast that they will come to make up an increasing share of the market in the next decade (see Figure 4–1). Because the number of new consumers is growing each year, and the number of information sources is growing as well, we think the way new consumers use information is a good indication of what resources are likely to be important for passing on information arising from the nutrigenomics revolution.

NEW CONSUMERS USE NUTRITION INFORMATION

Sophisticated new consumers stand apart from traditional consumers in the way they use information to make purchasing decisions. They tend to gather more information before each purchase; they go to a greater variety of sources or channels of information; and they use more of the new sources of information, such as Web sites. But they also read more books, look at more newspapers and magazines, and listen to the radio more often. All in all, they are much more likely than traditional consumers to go to sources that give detailed information.

*Figure 4–1
New Consumers Form a Larger Share of Market
(Percent of adult population that are new consumers, by year)*

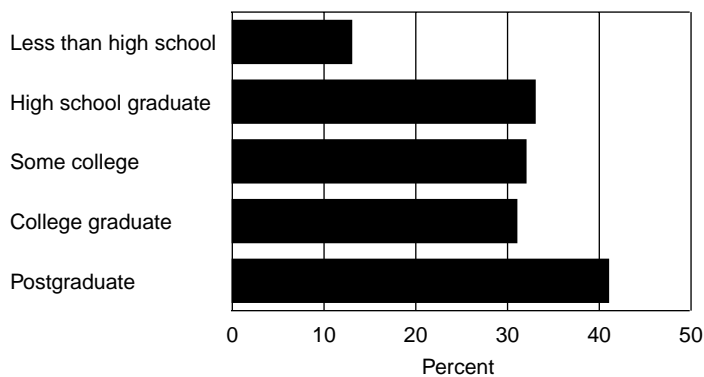


Source: Institute for the Future

Because of their skills and experience searching for all kinds of information from all kinds of sources, new consumers are less likely to be overwhelmed by nutrition information. In fact, a recent survey by the Fred Hutchinson Cancer Research Center found that people with higher levels of education or income actually had the lowest reports of worry and anger about dietary advice. Perhaps as a result, new consumers are particularly likely to want high volumes of nutrition information. Figure 4–2 shows that as the educational attainment of consumers rises, they are more likely to use a wide variety of independent sources of nutrition information.

Even—or perhaps, especially—when shopping for food, new consumers seek nutrition information. Our survey found that the majority (68%) of individuals either “always” or “sometimes” look at the “nutrition facts” label when deciding whether to try a new brand of food; new consumers are particularly likely to claim they always read nutrition labels (see Figure 4–3 on page 54).

Figure 4–2
New Consumers Search Widely for Nutrition Information
(Percent of consumers using six or more sources for nutrition information, by education)



Source: Institute for the Future, NCNG Household Survey, 2001.

.....
“I think it depends on how many advertisements are in that magazine. If it’s hyped up full ... with supplemental advertisements, I don’t think the magazine’s all that great.”

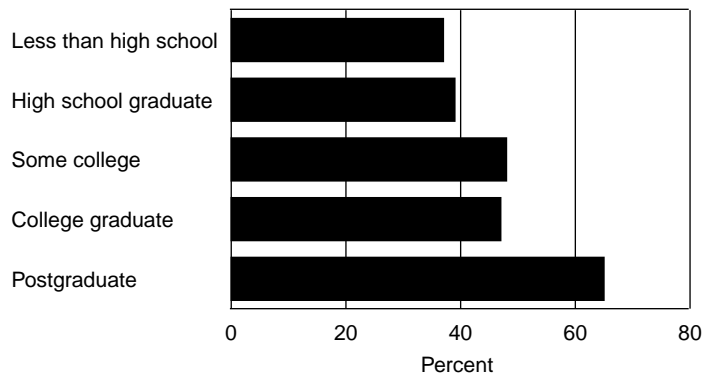
—A 29-year-old new consumer discussing the trustworthiness of magazines

New Consumers Are Skeptical

One reason new consumers are more comfortable with—indeed, even require—high volumes of information is that they tend to be skeptical by nature. They are less likely to believe any one source of information. In the words of one female new consumer from our focus groups, “You’ve got to hear it more than once.” In fact, new consumers are likely to take any one information source—even their favorite—with a grain of salt, particularly if the source has a lot of space devoted to advertising. For example, a 50-year-old male new consumer in one of our focus groups reported: “We get *Prevention* magazine ... they seem to want to sell you something in every article. They tell you to buy grapeseed extract. And on the next page might be an ad for a guy who’s selling concentrated grapeseed extract.”

Perhaps the best example of this skepticism lies in the distinction new consumers make between nutrition labels—which are federally regulated and perceived as “factual”—and any other information on food packaging, which is perceived as advertising. This other information might include health claims (e.g., that a product reduces the risk of

*Figure 4–3
New Consumers Likely to Always Read Nutrition Label
(Percent of consumers who claim they always look at the nutrition facts label when deciding to try a new brand of food, by education)*

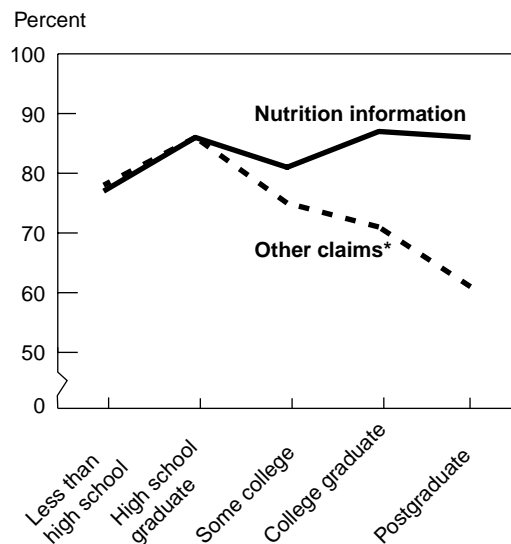


Source: Institute for the Future, NCNG Household Survey, 2001.

heart disease), environmental claims (e.g., that a product is environmentally friendly), or claims that there were no genetically modified ingredients or pesticides detected in the food.

We asked our survey respondents to rate the importance of these pieces of information when choosing among several new packaged foods for dinner. At the lowest levels of education, consumers perceived these types of information as equally important. New consumers, however, were more likely to think that the nutrition information was important, while they saw each of the other claims as less important (see Figure 4-4). New consumers are especially attuned to what information is likely to be used in service of selling the product, and are more likely to discount it.

Figure 4-4
New Consumers Think Nutrition Labels Are Important for New Purchases
 (Percent of consumers who thought the following were “somewhat” or “very” important when choosing a new packaged food to buy for dinner, by education)



*Percentages for this category, which includes health and environmental claims and claims about genetically modified ingredients and detectable pesticides, showed similar trends and were averaged.

Source: Institute for the Future, NCNG Household Survey, 2001.

.....

“I don’t really believe too much what they say ... because sometimes they tell you that something is good and then later on they’ll turn around and say it’s bad.”

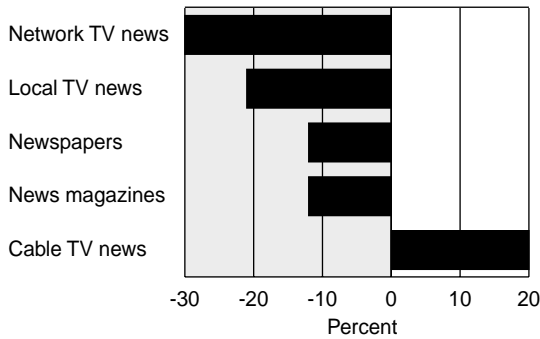
—A 19-year-old female new consumer describing her perception of changing nutrition guidelines

Information that seems inconsistent or contradictory is a red flag that increases new consumers' skepticism. Examples include research reports that make contrasting conclusions, information from trendy diets that contradicts established nutrition research, or simply the changes in understanding that come with a growing field of knowledge about nutrition. For example, one female new consumer complained about perceived inconsistencies: "One day bacon's good to eat, the next day bacon's not good to eat. One day this coffee's good, the next day don't drink coffee." This frustration over the quality of information is likely to be a continuing issue, as future scientific breakthroughs will take some time to be assimilated into the current knowledge base.

INFORMATION FLOWS: NEW CONSUMERS DO IT DIFFERENTLY

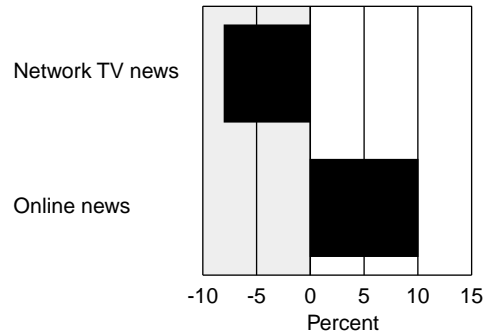
Within the past decade, consumers' use of media has shifted dramatically. People who watch the news, for example, have shifted away from mass media channels toward more targeted channels. The Pew Research Center's biennial news use survey has found a particularly sharp trend in the move from network TV news to cable TV news, and to online news sites (see Figures 4-5 and 4-6).

*Figure 4-5
Traditional News Channels Used Less
(Change in percent of public who regularly watch or read ..., 1993-2000)*



Source: Pew Research Media Report, 2000.

*Figure 4-6
Online Information Grows
(Change in percent of public who regularly watch or follow ..., 1998-2000)*



Source: Pew Research Media Report, 2000.

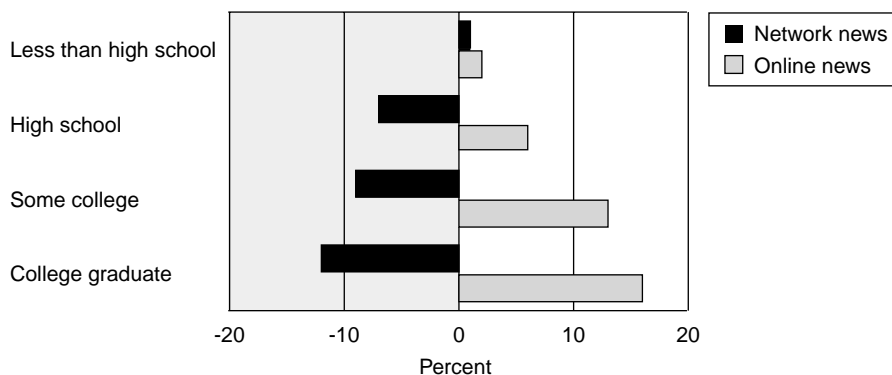
More important, however, is that this shift from mass media to more targeted media doesn't occur equally across the population—new consumers are leading the way. Individuals with at least some college education show a stronger shift away from network news programs to new sources they select themselves (see Figure 4–7).

Consumers are highly interested in health and science stories. The Pew Research Center's biennial news use survey found that of all the news stories followed, health and science ones ranked near the top in interest. Consumers reported that both on TV and online, health was the second most frequently followed or accessed topic (after crime on TV and weather online). Overall, trends in media use have an important effect on how consumers get information about health and nutrition. New consumers are much more likely to use more sources for information in their search for data they trust.

Doctors and Medical Reference Books

When looking to the health care system for information, new consumers are likely to rely on both mainstream sources, such as physicians, and specialized sources, such as medical reference books and journals.

Figure 4–7
New Consumers Lead the Media Shift
(Change in percent of public who regularly view ..., 1998–2000, by education)



Source: Pew Research Media Report, 2000.

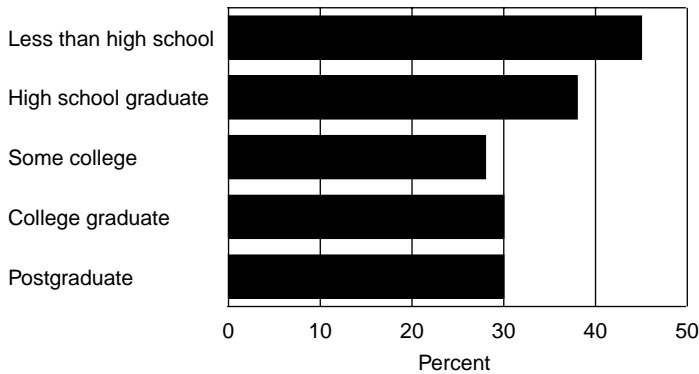
Although new consumers heavily use both types, they report different patterns of satisfaction with the information they receive from them.

Physicians Are Slightly Less Trusted

Most people see physicians as the most trusted of the sources. New consumers do so as well, but they put much less trust in physicians than others do. In general, physicians are seen as trusted sources of nutrition information because they have a reputation for having the patients' best interests at heart. For example, a 30-year-old male new consumer said: "I'll listen to a doctor who doesn't have anything he's trying to gain from it, because he'll tell you the way that it normally goes If you go to the impartial sources—doctors who do nothing more than provide for your health, health care professionals—those types of people, I'll listen to."

Despite their trust in doctors, new consumers were actually *less* likely to report that doctors were useful providers of nutrition information (see Figure 4–8). Rather than focus on doctors as a trustworthy source above all others, as traditional consumers do, new consumers feel doctors are only somewhat more trustworthy than a range of other sources.

*Figure 4–8
New Consumers Find Doctors Less Useful
(Percent of consumers who reported that doctors were one of the two most useful sources for nutrition information, by education)*



Source: Institute for the Future, NCHS Household Survey, 2001.

There are probably many reasons behind this attitude—one may be that new consumers strongly prefer to have access to information at their convenience, and it may be too difficult to schedule a quick visit to a physician at the time they most want information. Furthermore, to the extent to which primary health care providers are time-stressed in their interactions with patients, new consumers may perceive them as not being fully committed to explaining all the relevant information.

New consumers are likely to see doctors' input as an important, but not the only, source of information. New consumers trust and value the advice of their doctors—and use that advice in combination with other, more readily available sources. For example, participants in our focus groups claimed that they used the Internet in connection with doctors' advice about nutrition to clarify issues and to get more information. One female new consumer explained: “A lot of the things that [doctors] told me, I did look up on the Internet. I didn't know what pancreatitis was. And then they gave me their medical mumbo-jumbo, and I *still* didn't know what pancreatitis was. I found it on the Internet and now I know what it is. I know what causes it.... But all that information [originally] came from my doctor.”

Journals, Magazines, and Books Are Useful

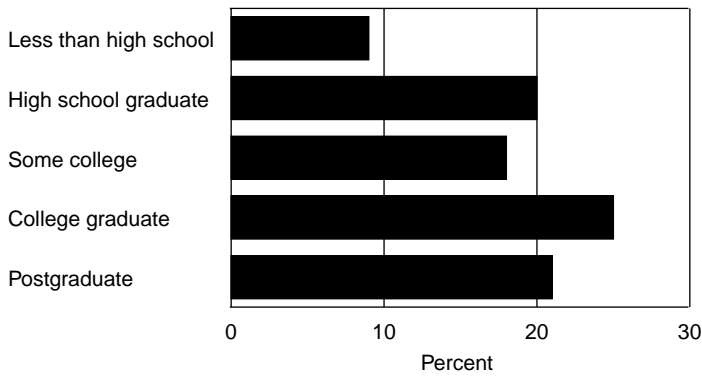
Given that medical reference books and medical journals are used less often overall, it is significant that new consumers see them as important sources of nutrition information. Almost 60% of people with postgraduate education reported reading medical reference books, journals, or newsletters in order to obtain nutrition information, as compared to only 38% of people who did not graduate from high school. Clearly, education helps in understanding this information (see Figure 4-9 on page 60). That these sources are an established part of the academic publishing process suggests to consumers that they are trustworthy. One female new consumer explained: “Well, if it's a company that's touting their product versus something from *New England Journal of Medicine*, or something like that, there's quite a disparity there ... because there's credible research to back up what [the *New England Journal of Medicine* is] saying, typically. It's been reviewed and so forth.”

.....

“I think I would want more opinion than just from my doctor. I'd like more information. ... You could probably go in to research ... [at] the library. I'd find a way to find out. Because it's one man's opinion.”

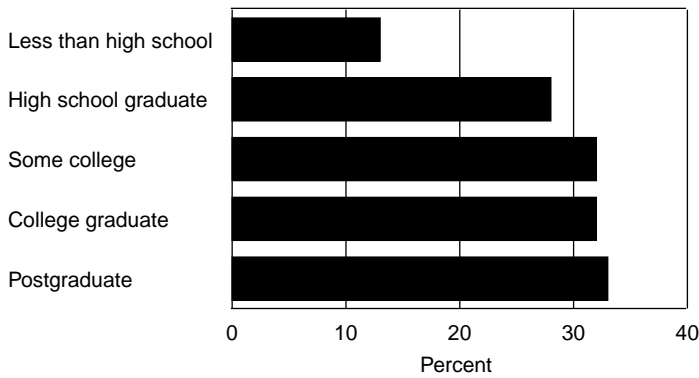
—A 47-year-old female new consumer on how she views her doctor's advice

Figure 4–9
New Consumers Find Medical Reference Books, Journals, and Newsletters Useful
(Percent of consumers who reported that medical reference books, journals, and newsletters were one of the two most useful sources for nutrition information, by education)



Source: Institute for the Future, NCNG Household Survey, 2001.

Figure 4–10
New Consumers Find Popular Magazines and Books Useful
(Percent of consumers who reported that popular magazines and books were one of the two most useful sources for nutrition information, by education)



Source: Institute for the Future, NCNG Household Survey, 2001.

Consumer Media

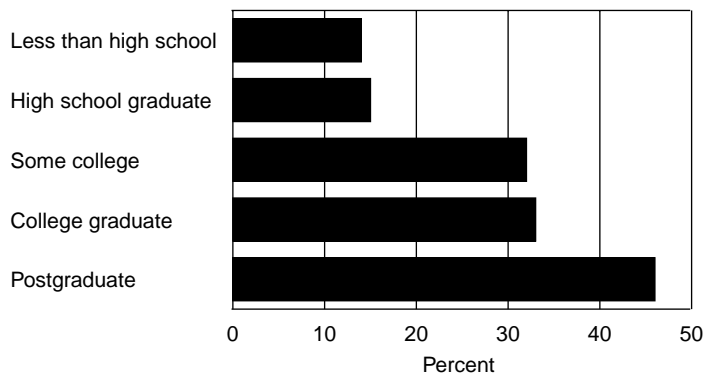
Like other consumers, new consumers read popular books and magazines. And as with other information sources, new consumers find value in what books and magazines say about nutrition (see Figure 4–10).

The Internet

Given new consumers' patterns of combining doctors' advice with searches on the Internet, it makes sense that new consumers would be particularly likely to use health Web sites, such as WebMD, to get nutrition information. Although only 25% of our survey sample used consumer-oriented health Web sites, those who did were much more likely to be new consumers (see Figure 4–11). New consumers were also particularly likely to perceive such Web sites as providing useful nutrition information (see Figure 4–12 on page 62).

Web sites for specialized organizations high on the information flow are likely to be the winners here. For example, a 30-year-old male new

Figure 4–11
New Consumers More Likely to Use Health Web Sites
(Percent of consumers who used health Web sites to look for nutrition information, by education)



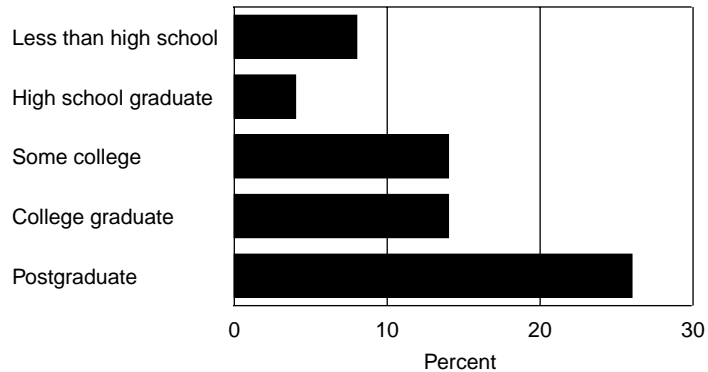
Source: Institute for the Future, NCNG Household Survey, 2001.

consumer explained: “*New England Journal of Medicine* has a pretty good Web site. So does *Journal of the American Medical Association*. They both have pretty good Web sites. There are studies on those sites. You can actually read what people were saying about whatever it is you’re looking for.”

New consumers also like to use Web sites to follow up on information they heard through other channels. A 63-year-old male new consumer said: “I went onto the Internet to the television station to find out what they were saying [about a nutrition story].... I wanted to get a little bit more than that little blip that they put on for one minute, and find out where their research came from.”

Of course, Internet sites can vary widely in the quality and trustworthiness of the information they provide. Research on how consumers use Internet sites for health information is illuminating. A recent survey by the Pew Internet and American Life Project found that 86% of respondents were concerned about getting unreliable health information, yet 64% said they consulted Web sites they had never heard of

*Figure 4–12
New Consumers Find Health Web Sites Useful
(Percent of consumers who reported that health Web sites were one of the two most useful sources for nutrition information, by education)*



Source: Institute for the Future, NCNG Household Survey, 2001.

prior to their search. Clearly, people are gathering a wide spectrum of information so they can more fully assess the information they are receiving.

The Internet is also useful because it helps consumers aggregate the experiences of others. Consumers find others' experiences with food products to be useful, as they can contain detailed information, yet are unlikely to be biased. One new consumer explained: "If you think this particular procedure, this particular product, is good, and you go on the Internet and you find a lot of Web sites or bulletins where people are saying it's good ... you can maybe find individuals that say, 'It did not work for me.' So you start searching more and more. Then you may find out that yes, it is working for a lot of people, or no, it's not working for a lot of people." Thus, new consumers appreciate that the Internet lets them perform "mini-surveys" to assess information or products.

The Food Industry

Our research clearly suggests that new consumers have less faith in sources associated with food distribution itself, sources such as product manufacturers and grocery stores. For example, new consumers are less likely than traditional consumers to see supermarkets as a useful source of nutrition information (see Figure 4-13 on page 64). In our focus groups, any company involved in making and distributing products—including grocery stores, nutritional supplement stores, product manufacturers, and pharmaceutical companies—was suspect. One female new consumer put it succinctly: "They just want to sell." A male new consumer agreed: "I'll read a lot, but I won't take the advice of anybody who's trying to make a living off of what they're trying to tell me, because they've usually got an angle they're trying to follow... [There are] a myriad of people out there that are trying to make money by somehow finding a different angle to push their nutritional values."

New consumers are so sensitive to the motivations of food or drug distributors that even a highly respected source, such as a physician, can become suspect. A few of our focus group participants were concerned about the possibility of pharmaceutical companies inappropriately influencing their doctors. One 48-year-old female new consumer argued: "[Pharmaceutical] companies come in and say, 'Here are a lot

.....

"You know, there's more than one Internet site too. How many times do you get the same answer or the same response to an item? And if it's repeated over and over again by different sources, you might accept it."

—A male new consumer discussing how he comes to believe nutrition information he finds on the Internet

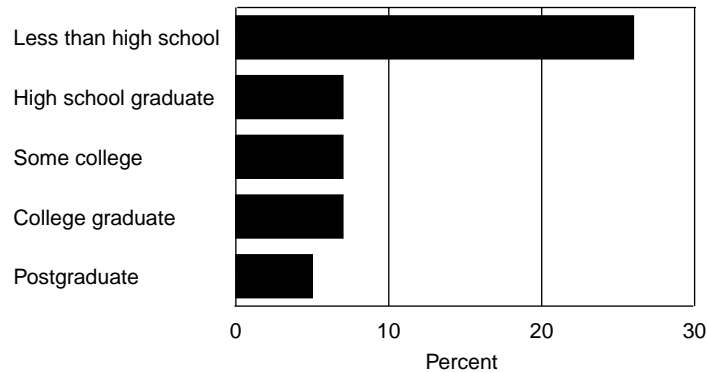
.....
“If they were selling something—you know, if they had an interest behind it, I don’t think you can ever trust that.”

—A 26-year-old male new consumer claiming that any company involved in consumer retail is untrustworthy

of freebies. Push my product.’ So you have to be careful when you’re going to your doctor as well—especially if they open their drawer and give you a handful of their product and then say, ‘Here’s your prescription for it.’ ”

The problem is not only that retail companies want to sell their products, but also that salespeople who assist the customers in stores may not be experts on the products. For example, one 56-year-old new consumer explained: “The problem is, you go in [to a nutrition store] and you go up to the counter and say, ‘I need something for this.’ Well, the person you’re talking to doesn’t know any more than you do. I mean, they just came off the street and were hired as a sales clerk.” In the eyes of new consumers, there are multiple problems with retailers as a source of nutrition information.

*Figure 4–13
New Consumers Less Likely to Think Supermarkets Useful
(Percent of consumers who reported that supermarkets were one of the two most useful sources for nutrition information, by education)*



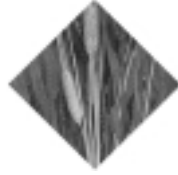
Source: Institute for the Future, NCNG Household Survey, 2001.

CONCLUSION:**PROVIDE IMPARTIAL AND THOROUGH INFORMATION**

There is a large and growing number of new consumers, and they are having an increasing influence on the global marketplace. Good information is important to them, including nutrition information. When they are dealing with nutrition information, they gather and process data from a variety of sources, both general and specialized, before making decisions. New consumers are very sensitive to the motivations of information providers, and they place the most trust in sources that seem impartial. Providing evidence from a range of sources that confirms the claims companies are making for their products is one way to counter new consumers' skepticism.

For these reasons, anyone trying to persuade the all-important new consumer to change behavior must be prepared to communicate through a wide range of channels—even those that aren't used very much for mass communications, such as medical and scientific journals. Indeed, to reach the new consumers, companies must be prepared to change the way they communicate important information about their products and the way consumers receive it. But first, these companies must understand how consumers use information to modify their behaviors.

CONSUMERS *DO* CHANGE, GIVEN GOOD INFORMATION



Consumers' interest in information about nutrition does translate into behavior, especially with new consumers. While information will be a deep driver of the nutrigenomics revolution, ultimately, it will be consumers' behaviors, in the form of demand for special products and the willingness to pay for them, that will transform the food industry.

INFORMATION IS EMPOWERMENT

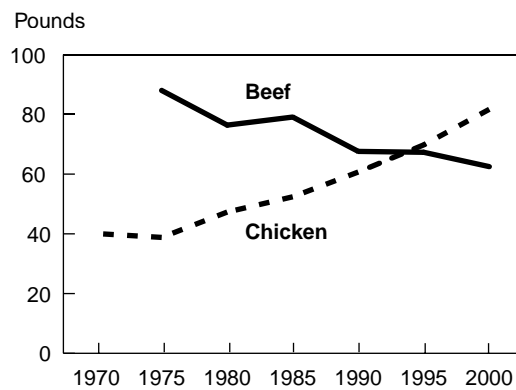
Americans are taking more control over their own health care. A 2001 survey done for the Consumer Healthcare Products Association found that 59% of Americans reported that they were more likely to treat common ailments themselves than they were a year before.

Because consumers are taking more control of their own care, the way that some products are distributed has changed dramatically. One of the striking examples in the health care field during the last decade has been the manner in which new drugs are marketed. At the beginning of the 1990s, almost all advertising for drugs was targeted to physicians, who then wrote prescriptions for patients. But a 1997 law gave pharmaceutical companies more leeway in advertising prescription drugs directly to consumers. By the end of the decade, over \$2 billion in drug advertising—or about 17% of their total advertising budget—was spent on direct-to-consumer marketing, such as magazine and TV advertisements. While there is growing activity to reach consumers directly in the health market, the pace of change in the nutrition market has been slower to develop. The expansion of the nutritional supplement market and the growth of “health food” grocery chains like Whole Foods show that there are signs of change there as well, but the fact is that Whole Foods, which is growing at a rate of 39% per year, still accounts for less than 0.5% of total food sales.

NUTRITION CHANGE IS HAPPENING, SLOWLY

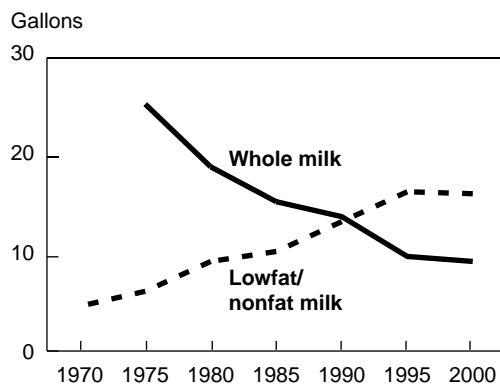
Despite the slow growth in the health food market, Americans are showing more concern about their health overall and, even better, doing something about it. U.S. Department of Agriculture (USDA) data indicate that, since 1970, Americans’ food supply has been increasingly lower in fat and higher in minerals and vitamins. Consumers are increasingly choosing healthier versions of basic foods; for example, choosing chicken instead of red meat (see Figure 5–1). Similarly, low-fat and nonfat milk have now replaced whole-fat as the milk of choice among consumers (see Figure 5–2).

Figure 5-1
Consumers Choosing Chicken Over Red Meat
(Per capita consumption in pounds)



Source: U.S. Department of Agriculture, Economic Research Service.

Figure 5-2
Consumers Choosing Lower-Fat Milk Over Whole-Fat Milk
(Per capita consumption in gallons)



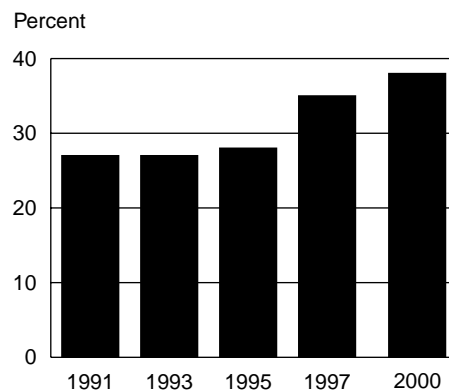
Source: U.S. Department of Agriculture, Economic Research Service.

Consumers are also increasingly likely to believe that supplements are important additions to their diet. A recent study by National Public Radio and the Kaiser Family Foundation discovered that about half (52%) of all consumers think that vitamin supplements are good for people's health and well-being, mostly because they help with minor illnesses such as colds or flu. In fact, rising numbers of people feel that supplements are actually necessary for good health (see Figure 5-3). Many consumers place a high priority on reaching out to find the products that will contribute to a healthy life.

AMERICANS NEED MORE DIET CHANGES

Despite the clear trends toward healthier eating, there are still more changes needed. The USDA has tracked Americans' diets with the Healthy Eating Index (HEI), a measurement based on the extent to which individuals' diets conform to the USDA Food Guide Pyramid, the percentage of fat, saturated fat, cholesterol, and sodium in

Figure 5-3
More Consumers See Vitamin Supplements as Necessary
(Percent who agreed with the statement: "Taking vitamin supplements is necessary to ensure good health.")



Source: American Dietetic Association, Nutrition and You: Trends 2000 Survey.

their diet, and the degree of diet variety. An HEI score from 80 to 100 implies healthy eating or a good diet; a score between 51 and 80 suggests the diet needs improvement or is a problem; and a score of 50 or less implies a poor diet. In 1996, the latest year for which national data are available, the average HEI score for the U.S. population was 64. The diet of most Americans (88%) landed in the “needs improvement” category or worse, while only 12% of the population had a good diet (see Table 5–1). Furthermore, there has been little change in the HEI since 1989, despite the introduction of several federal nutrition education initiatives such as the Food Guide Pyramid and the Nutrition Labeling and Education Act. Clearly, there is much progress to be made before most Americans can be said to have a good diet.

One important reason why Americans do not have more nutritious diets is that they frequently eat outside the home. USDA research indicates that food eaten outside the home is less likely to be nutritious than food eaten at home—that is, more likely to be high in fat and

Table 5–1
Incremental Changes in Diet in the 1990s
(Percent of population in each HEI category)

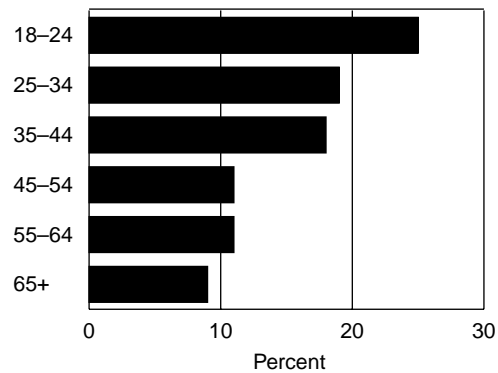
	1989	1996
Healthy eating	11	12
Needs improvement	76	71
Poor	14	17

Source: Institute for the Future; data derived from U.S. Department of Agriculture, Healthy Eating Index.

saturated fat, and lower in calcium, fiber, and iron. Yet this is exactly the food that Americans are consuming in growing quantities. The USDA estimates that the frequency of dining out has increased by two-thirds over the past 20 years, from 16% of all meals and snacks between 1977 and 1978 to 27% in 1995. Our survey indicates that consumers eat an average of two dinners per week outside the home, but there are indications that this number is on the rise. Younger consumers are particularly likely to eat outside the home, a trend that bodes ill for their future health (see Figure 5-4).

Clearly, there is much call for Americans to continue improving their diets. And a small but growing group of them are leading the way—the new consumers, who, because of their willingness to change behaviors, will be the likely market for nutrigenomic foods and services.

*Figure 5-4
Young Consumers Likely to Eat Outside the Home
(Percent of consumers who eat less than four dinners per week at home, by age group)*



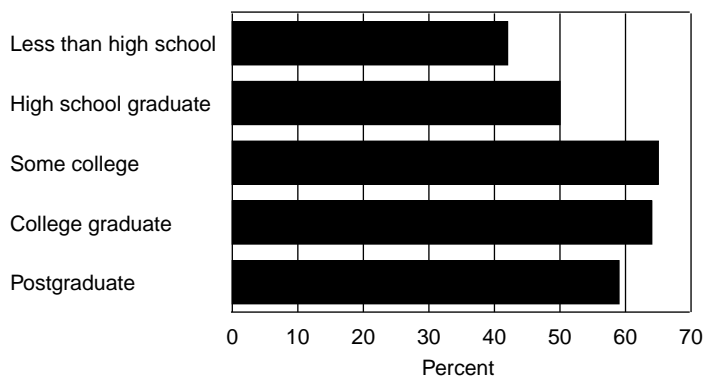
Source: Institute for the Future, NCNG Household Survey, 2001.

NEW CONSUMERS ARE LEADING THE DIET CHANGE

In the years we have tracked new consumers, we have found them to be at the leading edge of many consumer developments. They've led the way in adopting new personal technologies like computers and mobile phones, they've embraced direct-to-consumer shopping (online and catalog shopping), and they've pushed for changes in the workplace, including a better work-life balance. In our research on the adoption of the fruits of the nutrigenomics revolution, we are also finding that new consumers are most likely to lead the movement toward healthier diets, and thus, eventually, toward the nutrigenomics marketplace.

For example, new consumers are more likely to take control of their diets and more likely to report that they are making major changes to their diets. Although new consumers do change their diets when their doctors tell them to (i.e., when it is medically necessary), they are more likely than other consumers to report making proactive changes independent of doctors' recommendations (see Figure 5-5).

Figure 5-5
New Consumers More Likely to Change Their Diets Proactively
(Percent of all diet changers whose doctors did not recommend their change, by education)



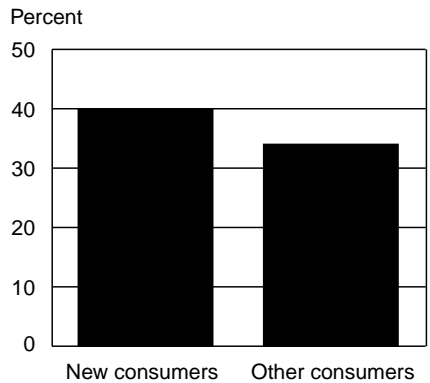
Source: Institute for the Future, NCNG Household Survey, 2001.

New consumers are also more comfortable experimenting with new products and services. When shopping for foods, they are 18% more likely than traditional consumers to report buying two or more new grocery brands each shopping trip (see Figure 5–6).

In particular, new consumers are more likely to experiment with foods that they believe to be healthier, such as organic foods. A recent survey by the ADA found that most consumers perceive that organic fruits and vegetables are healthier than non-organic versions. New consumers are more likely to report that they buy organic foods at least occasionally (see Figure 5–7). Such products are likely to appeal to new consumers because of their reputation for health and safety.

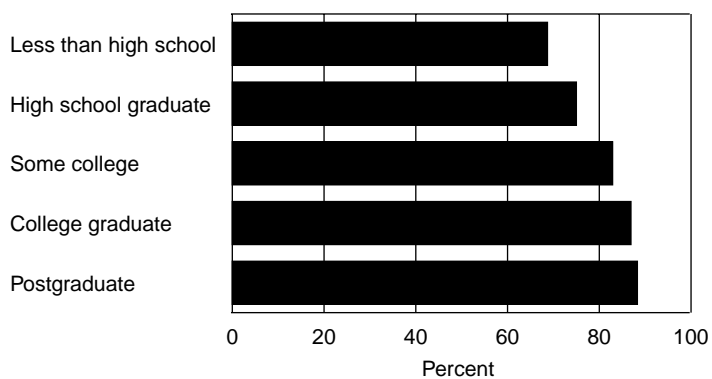
New consumers are also more likely to make an ongoing commitment to an improved diet. For example, they are more likely to report using supplements daily (see Figure 5–8).

Figure 5–6
New Consumers More Likely to Experiment with
New Grocery Products
(Percent of consumers who report buying two or more new grocery
brands each shopping trip)



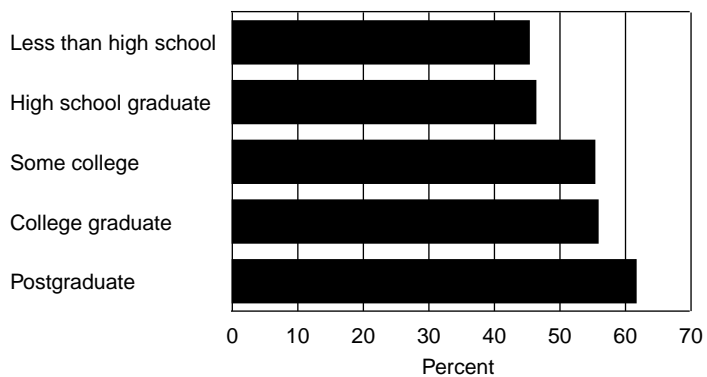
Source: Institute for the Future, Corporate Associates Program, Brands Survey, 1998.

Figure 5–7
New Consumers More Likely to Try Organic Foods
(Percent of consumers who have bought organic foods at least occasionally, by education)



Source: Institute for the Future, NCNG Household Survey, 2001.

Figure 5–8
New Consumers Use Supplements Daily
(Percent of consumers who report using dietary supplements daily, by education)



Source: Institute for the Future, NCNG Household Survey, 2001.

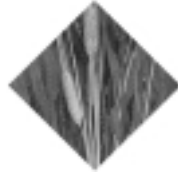
All in all, our surveys suggest that new consumers are health-oriented, proactive, and interested in maintaining positive changes to their diets. As with new consumers' behaviors in other areas, much of this behavior concerning health and nutrition is driven by their sophisticated use of information.

CONCLUSION: INFORMATION CHANGES BEHAVIOR

In general, diet changes have been slow in the United States. Still, a small but growing group is changing its behavior when there is strong evidence of the value of such changes. What gives strong evidence of value is good information, especially from trusted sources. Such information does have an impact on how new consumers act with regard to food and nutrition. In the future, once the nutrigenomics revolution takes hold and detailed, specific, and credible information about food and nutrition becomes available, many new consumers will be poised to act. They will have the experience in changing their behaviors based on new information and the confidence to ask for products that make them healthier. In this way, they will play a large role in transforming the food industry.

In order for this transformation to occur, however, companies along the food supply chain will need to learn how to make valued information available to new consumers, by redirecting the information flows.

INFORMATION FLOWS BUILD THE NEW MARKET



The nutrigenomics revolution will create vast new flows of information that are relevant—perhaps even crucial—to consumers. More sophisticated consumers are more likely to realize that this information can make a big difference in their lives—and they will search for the information that will benefit them the most, use it, and pass it along.

For these reasons, information about nutrigenomics *will* make it into the marketplace, albeit in nontraditional ways, and help revolutionize the food industry—but only if such information gets into the right hands in the right way.

.....
The information-searching behaviors of new consumers will expand dramatically in coming years as detailed nutrition information becomes available.

NUTRITION INFORMATION: CHANGING THE FLOW

We expect to see a wealth of information from the nutrigenomics revolution in the coming years. In particular, we'll see more detailed information about an individual's genetic makeup or what combinations of genetic characteristics he or she shares with others in smaller population subgroups. This will enable people in these subgroups to identify particular micronutrients or phytochemicals that can have dramatic impacts on their health.

Many sophisticated consumers will find increasing value in learning how this information can improve their health and that of their families. As they find some useful information, they are likely to search an ever wider range of sources. We expect to see the information-searching behaviors of new consumers expand dramatically in coming years as detailed nutrition information becomes available.

As information about food and supplements becomes more valuable to the sophisticated consumer, a range of companies will bring added value to the food chain. But this added value will only be realized if the sophisticated consumer can find—or can be provided—information about the products that will make a difference. As we have discussed, it is difficult to do that in today's supply chain, where key players in two of the three major information flows—the health care system and the food industry—don't yet have a clear interest in disseminating revolutionary information about nutrition.

NEW TYPES OF INFORMATION COMING IN THE FUTURE

Down the line, the nutrigenomics revolution will provide the opportunity for consumers to learn information about their own genetic composition and to connect that to particular foods or supplements best suited to their individual genetic makeup. In the meantime, consumers will begin to hear or see new information in the literature and popular media in the next decade, information that represents important guideposts along the road to the ultimate goal of personalized diets (see Table 6-1).

In the next decade, a flood of information about the connection between genes and health will appear in different channels. Even though

that information will be far more detailed and relevant than the information of the past several decades, it will be confusing and incomplete at times. Since there will be lots of information, some of it pushing contrary options, it will not be easy for an individual to sort through it all.

This information will flow only reluctantly through the regular health care system, since doctors and pharmaceutical firms have no monetary incentive to provide new information on nutrition. Some health care organizations do have dietitians on staff, but very few consumers interact personally and regularly with a dietitian. The food industry has a greater interest in providing such information and new food products based on that information, but these will come slowly, since there is

Table 6–1
Consumer Guideposts

- 2001** Cancer patients can get tailored treatments as their genetic “fingerprints” are linked to genetic subtypes of specific cancers.
- 2003** New testing will be available that allows individuals to type themselves against a standard set of genetic possibilities—individuals can identify themselves as members of specific population subgroups; for example, people with particular sets of genes linked to the likelihood of cardiovascular disease.
- 2003–2004** Reports will identify the nutrient characteristics of a range of new phytochemicals found in a variety of food plants; each of these phytochemicals will be linked to biochemical reactions that affect individual predispositions to disease.
- 2005+** Reports will link environmental factors—air- and water-borne chemicals, and the impact of components of food products, for example—to propensity for certain diseases.
- 2007+** Radically improved gene-mapping technology will allow scientists to begin predicting individual, rather than group, responses to micronutrients.

Source: Institute for the Future

.....
Sophisticated consumers will demand health-enhancing products from the marketplace—and they'll be willing to pay more for them.

little incentive in the supply chain to introduce new products that aren't likely to catch on right away. Consumers will have to do much of the information searching on their own. Of course, it behooves any company even remotely connected to nutrigenomics to get the information to these consumers in a way they are likely to receive it.

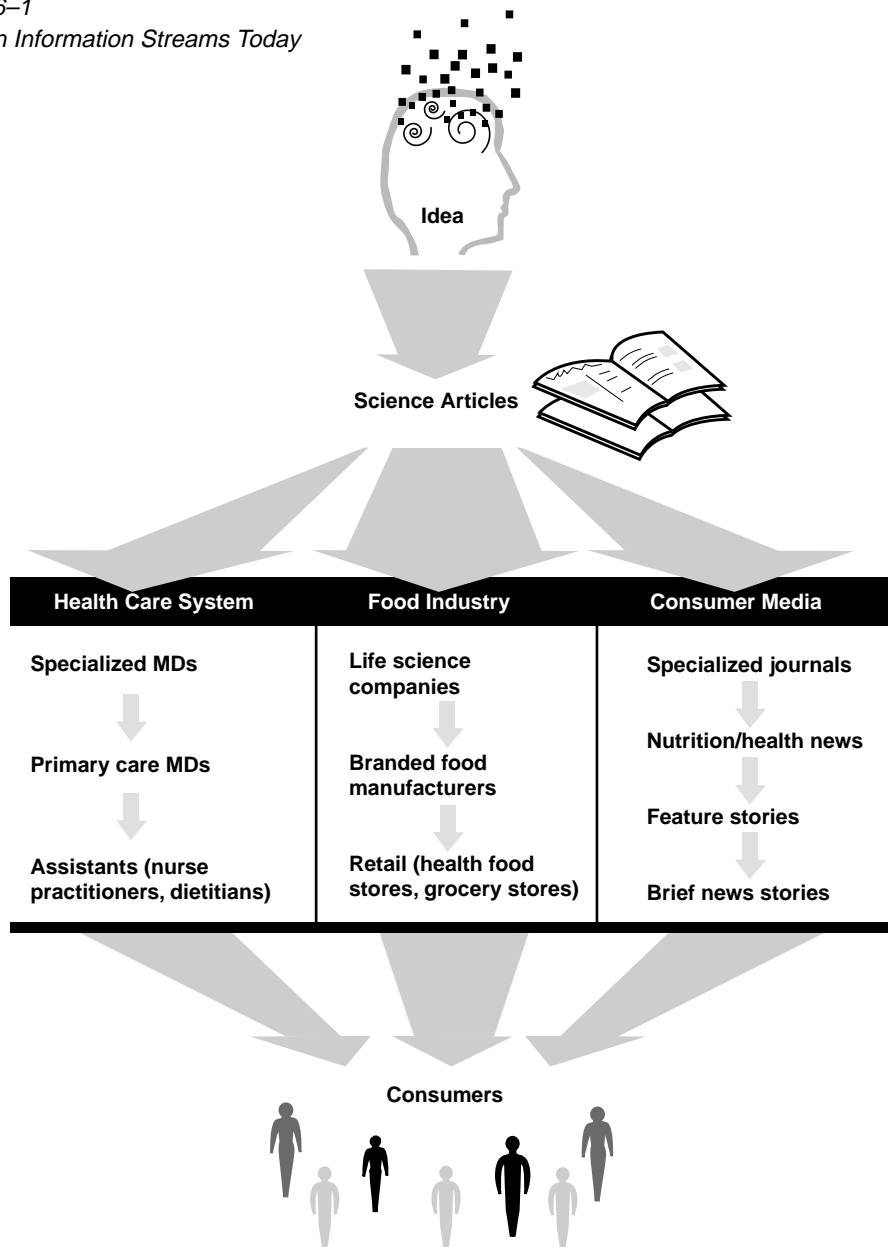
CONSUMERS MOVE UP THE INFORMATION FLOW

Despite the obstacles, nutrigenomic information will raise consumer interest. A small group of consumers will immediately try the latest products that make a strong claim that seems relevant to them. But this group of early experimenters will be only around 5 to 10% of the population. Far more interesting will be the response of a whole range of sophisticated consumers who make up 40 to 50% of the population, and who have shown they are interested in information gathering and analysis, including information about food and nutrition.

The sophisticated consumers will find themselves learning about nutrition possibilities through alternative sources. Many of these consumers will go back to primary sources—the more detailed articles in science journals and science-based Web sites. With this information, they will begin to accumulate their own body of knowledge about nutrition, food, and genetic testing, and about how these topics can be relevant to them. They will use this information to find the products they need. Once they come to value these health-enhancing products, they will demand them from the marketplace—and they'll be willing to pay more for them.

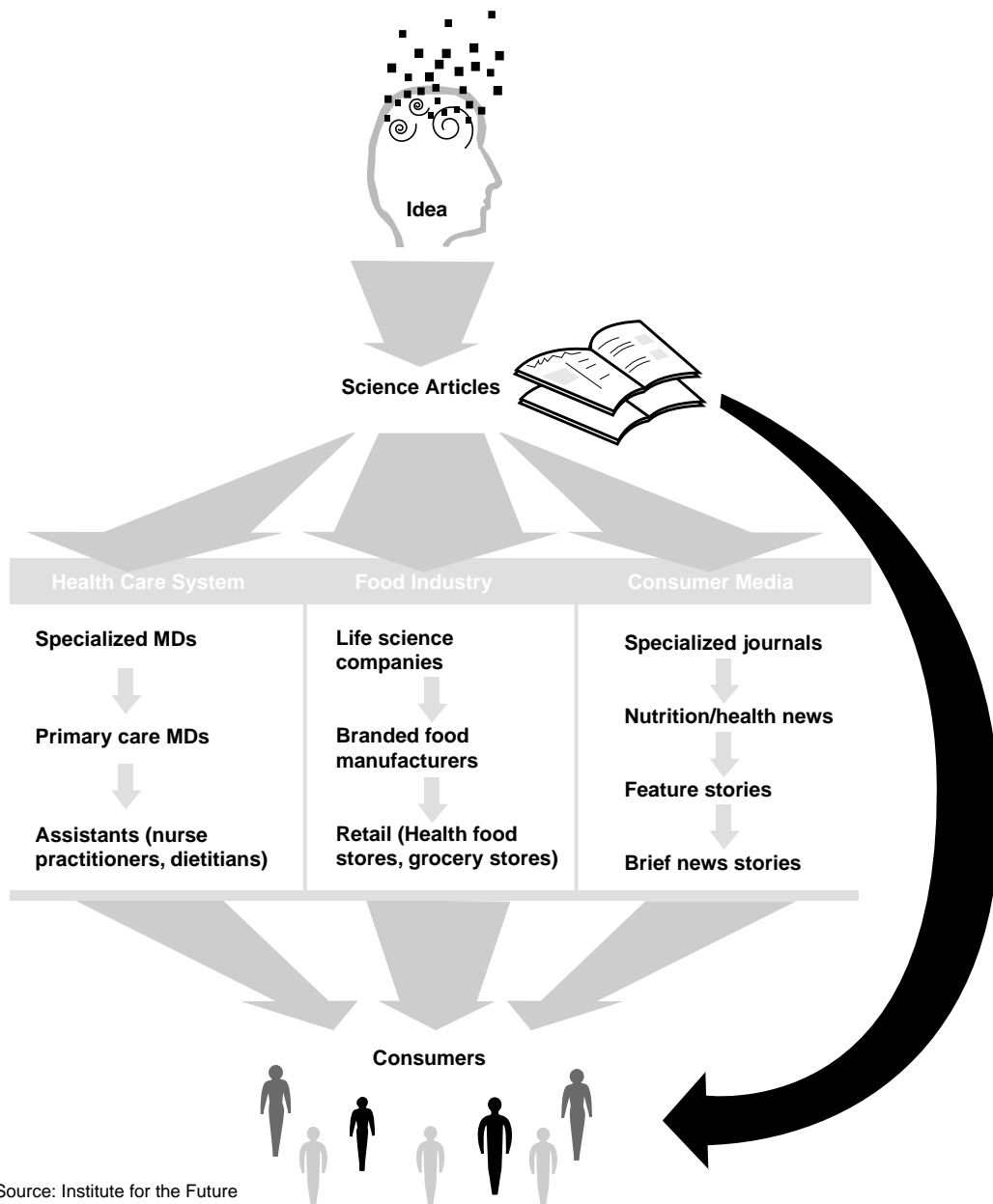
From the other side of the cash register, businesses will meet these consumers on their own ground by using a variation of the pharmaceutical model, whereby drug companies advertise directly to the consumer to persuade the consumer to request a prescription from their doctor. Thus, consumers will move away from their traditional use of information, in which information flows to the consumer through the popular media channels, and toward a model whereby the consumer becomes a more active participant in demanding goods by participating in the information-gathering process at an earlier stage. Figures 6-1 and 6-2, on the following pages, depict this transformation.

Figure 6-1
Nutrition Information Streams Today



Source: Institute for the Future

Figure 6–2
New Consumers Get Information Directly from the Source in the Future



Source: Institute for the Future

CONCLUSION: GOOD INFORMATION INTERESTS CONSUMERS

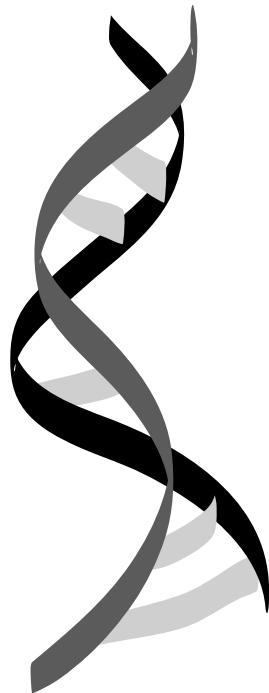
As shown in Figure 6–2, sophisticated consumers will increasingly bypass traditional channels for receiving nutrition information by finding targeted information relevant to their individual needs. They will get as close to the source of that information as possible to verify it. And they will begin to use that information to modify their daily behavior.

In the final chapters of this report, we take a closer look at the sophisticated consumers who will use nutrigenomics-based information to change their lives. We explore their impact on the food industry and forecast the resulting nutrigenomics market. Finally, we close with a chapter outlining strategies for businesses to succeed in the nutrigenomics market.

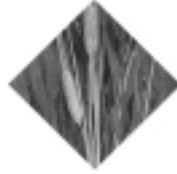
PART 4



Forecast and Strategies
for the New Market



FORECAST: NUTRIGENOMICS AND CONSUMERS IN 2010



Nutrigenomics will bring vast changes to the connections people make between food, nutrition, health, and disease prevention. These changes will cause many individuals to realize that the food they eat can have added value; that is, food can be more than a simple commodity.

We have identified a group of consumers—new consumers—who are likely to respond positively to the new information about nutrition. They understand the value of information: they search for information that is relevant to them; they are familiar with a variety of information sources; they are interested in nutrition; and they have shown that they are willing to alter their behavior if the information warrants such a change.

This intersection of scientifically based information of real value and sophisticated consumers ready to act on that information will transform the food industry. In 2010, by our own best estimates, about 33% of the consumer population will be gathering information derived from advances in nutrigenomics—and because they will see the real value of this information to their own lives, they will be willing to pay more for the products derived from this information.

How did we arrive at a calculation of the number of consumers likely to make real changes? First, we needed a concrete way to measure change. What we came up with is this—change can be measured by the share of consumers who are likely to be willing to pay more for the added value in a new food or other source of nutrition. Once we had a measurement tool, we used the results of our household survey to calculate the share of consumers likely to fall in this category because of current attitudes toward information, nutrition, health, and behavior. This group of consumers is likely to make up the nutrigenomics market in 2010.

THE MEASUREMENT STANDARD

In trying to determine the ways consumers might transform the food industry, we realized early on that, while change will begin with the flow of information about the new possibilities of nutrigenomics, only the real changes in behavior will drive the revolution. Which behavior speaks louder than any other in the marketplace? Paying for products, of course. A good starting point for identifying consumers who will create the nutrigenomics market, then, is to estimate the share of the population that meets the following criterion:

Those consumers who by 2010 would be willing to pay more for food or other products derived from nutrigenomic science.

This criterion gives us a more selective group of consumers than those who are likely to merely experiment with nutrigenomic products, since many experimenters would do so once or twice, as a passing fancy. It also distinguishes this group from consumers who would make a change in their eating habits that would depend only on foods and products that are already available. In essence, this criterion identifies those consumers willing and eager to change, consumers who might look to their own initiative to choose new products and who are likely to be willing to pay more when they find products that give them added value. We are not saying that they will all pay more for what they want, only that they would be willing to pay somewhat extra if the food or supplement was not readily available at current prices.

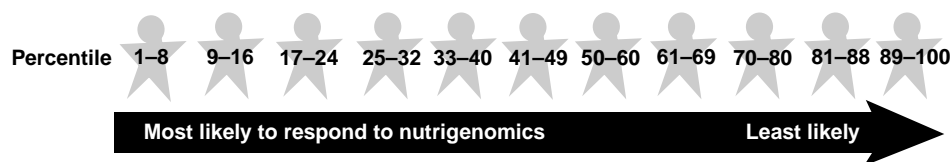
THE LIKELIHOOD SPECTRUM

To come up with a more accurate assessment of who is likely to buy nutrigenomic products and what percentage of the marketplace they are likely to make up, we have used our household survey to index consumers by their current attitudes and behaviors. This Consumer Nutrition Index (CNI), as we have come to call it, arranges consumers along a spectrum based on their interest in nutrition information and their likelihood of changing behavior toward food and nutritional supplements given compelling reasons to do so. Specifically, consumers' position on the index is based on two key variables: (1) their current utilization of nutrition *information*, and (2) their willingness to alter *behavior* as evidenced by major diet changes or use of nutritional supplements.

The CNI reads from left to right, with those segments of consumers on the left side having indicated the greatest interest in information as well as the strongest responses in recent behavioral adaptations (see Figure 7-1). Those groups of consumers who are least interested in nutrition information and least likely to have made a behavioral change are found on the right side of the CNI. The goal of the index is to estimate those consumers likely to respond to the new wealth of information that will be available from the field of nutrigenomics.

We recognize that the real flow of nutrigenomics-based information does not yet exist widely, and thus actual responses to it cannot be measured. Consequently, for consumers to respond to such nutrigenomics-

Figure 7-1
The Consumer Nutrition Index



Source: Institute for the Future

based products, they will have to act differently than they do today. To forecast just such changes, we measure major diet changes and supplement usage today as a proxy for the likelihood that, once these consumers learn about the positive impacts on their health of specific nutrigenomics-based foods or supplements, they would be willing to adapt their behavior and pay more for such products, if necessary.

In other words, our rationale is this: If in the future the market for nutrigenomics-based products and services depends on new information coming to consumers about the value of these products and services, then the segments of today's consumers who already make changes based on information they receive about nutrition are the ones most likely to adopt nutrigenomics-based products and services in the future and pay more, if necessary.

We define the interest in nutrigenomic information in relation to the number of different sources a consumer currently reports using to actively search for nutrition information. Respondents chose from a list of 11 possible answers, with heavy information users actively using more than half of the sources listed (see Table 7-1).

The other component of the CNI is behavior toward food and nutrition. The two variables we use to define such behavior are major changes in diet and how recently they occurred, and the frequency of use of nutritional supplements (see Table 7-2).

Table 7-1

CNI – Information

Heavy information users use six or more sources for nutrition information

<i>Heavy information users</i>	6+ sources
<i>Moderate information users</i>	2 to 5 sources
<i>Low information users</i>	1 source
<i>None</i>	0 sources

Source: Institute for the Future, NCNG Household Survey, 2001.

Specifically, in the survey we asked consumers whether they made a major change to their diet or eating habits in the last ten years. Those who responded that they made major changes to their diets in the last year are those most likely to be adapting their diets regularly in response to new information about nutrition. Consequently, these people are those who display the strongest behavioral diet adaptations.

We also asked consumers how often they use supplements—daily, weekly, only when they feel sick, or never. As supplement usage represents an additional dietary expense, these consumers have already exhibited the willingness to pay more for nutrition.

Combining major diet changes and supplement usage gives us the behavioral component of the CNI, which parallels the information component (see Figure 7–2 on page 92).

Those consumers who display very strong behavioral characteristics in addition to heavy information usage are the most likely to respond to new information, in particular to advances in science or nutrition. These consumer segments, on the far left side of the CNI, have the highest likelihood of reforming their diets in 2010—being willing to

Table 7–2

CNI – Behavior

Very strong behaviors include major diet changes less than one year ago and daily supplement use

Behavior Category	Definition (diet change and supplement frequency)
<i>Very strong</i>	Recent major diet change and/or daily supplement use
<i>Strong</i>	Less recent major diet change and/or daily supplement use
<i>Moderate</i>	Less recent major diet change and/or occasional supplement use
<i>Low</i>	Diet change made seldomly and/or occasional or no supplement use
<i>None</i>	No major diet change; no supplement use

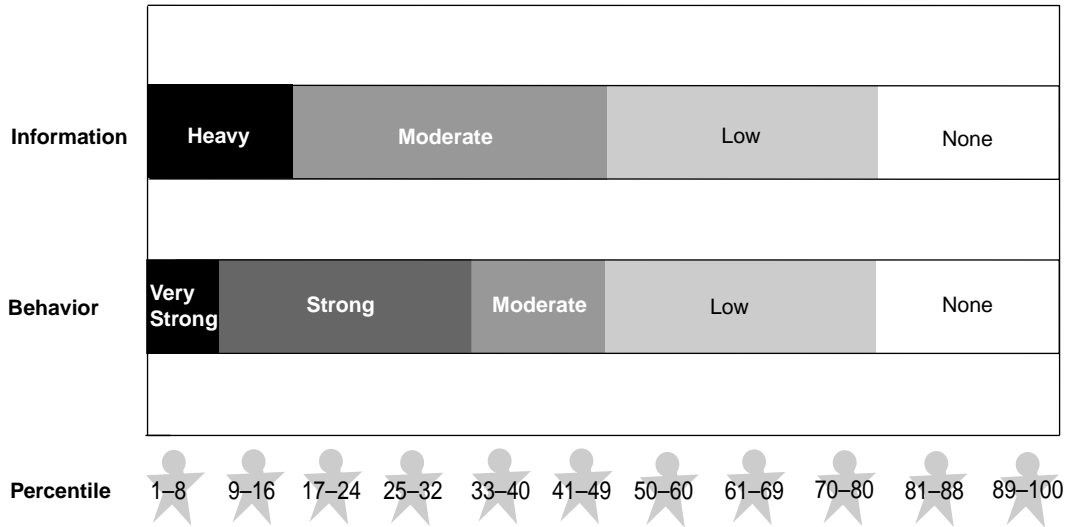
Source: Institute for the Future, NCNG Household Survey, 2001.

pay more by making a major diet change or by adding new supplements—based on emerging information about nutrigenomics.

CHARACTERISTICS ALONG THE SPECTRUM

We divided the CNI into segments of roughly 8 to 10%, and analyzed the segments by demographic and behavioral variables. Not surprisingly, new consumers tend to be bunched on the left side of the spectrum. We also find that certain behavioral characteristics—like the use of organic foods—also bunch to the left. Other factors, however, such as age, are spread out more randomly.

Figure 7-2
Information and Behavior Define the CNI



Source: Institute for the Future

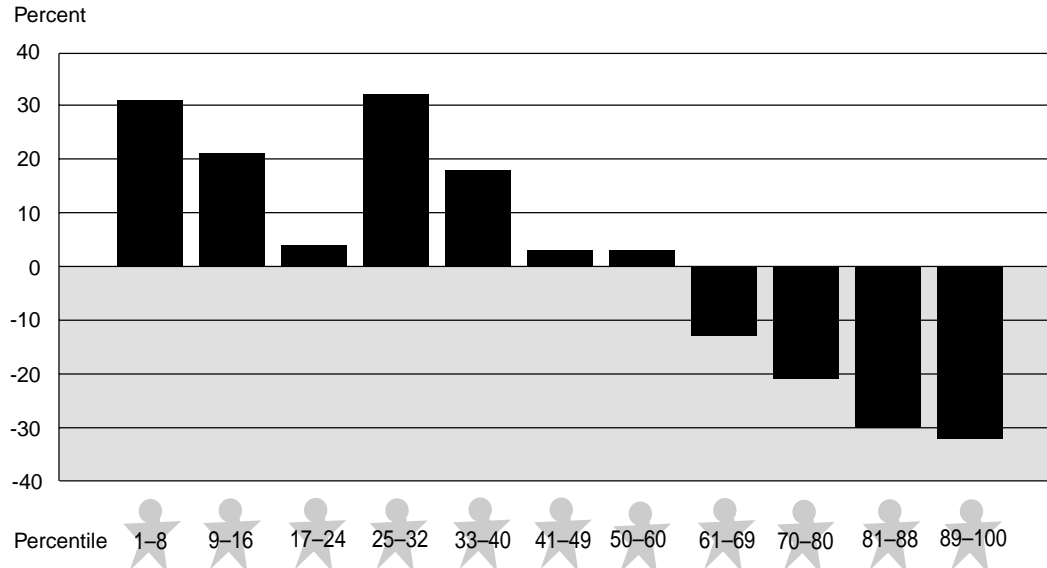
New Consumers and the Consumer Nutrition Index

The left half of the CNI—that is, the groups most likely to adopt nutrigenomic foods—is populated by new consumers. In Figure 7–3 we use education as a proxy for new consumers. A closer look reveals a more than 30% greater likelihood that consumers with at least some college education fall into the first group—the 1st to 8th percentile—of the CNI than anywhere else. The further we move to the right, the less the likelihood. Consumers who use nutrition information more intensively generally are those who have been educated to appreciate the virtues of gathering and analyzing data.

Figure 7–3

New Consumers Will Be Likely Responders

(Increased/decreased likelihood of consumers with at least some college education to fall in ... percentile on the CNI)



Note: The numbers above represent the percentage likelihood of each group to fall in that percentile of the CNI, based on the group's average. For example, consumers with at least some college education are 32% more likely to fall between the 25th and 32nd percentiles of the CNI than they are to fall anywhere else on the spectrum, on average. The number is calculated by dividing the total percentage of those in the survey with at least some college education into the percentage found at each percentile, above. This number gives the increased or decreased (if negative) likelihood of a member of that particular demographic or behavioral group to fall within a specific segment, or percentile, of the CNI.

Source: Institute for the Future, NCNG Household Survey, 2001.

There is an interesting drop in the likelihood of new consumers being in the third subgroup, which consists of moderate information users with relatively strong behavioral modifications. This group consists of an inordinately large segment of younger adults who have probably not completed their education and, so, look surprisingly less educated. In general, however, education rates steadily decline moving left to right across the CNI. Consequently, those who are the heaviest information users and display the strongest behavioral responses to new information are likely to be new consumers.

Users of Organic Products and the Consumer Nutrition Index

We asked our survey respondents about their use of organic products. If we assume that those who use organic products do so out of concern for their health, then our CNI data tell us that the more heavily a person searches for information and the more marked this person's behavioral responses are (in terms of major diet change and supplement use), the more likely he or she is to purchase organic products. Those consumers using organic products today, then, may be early indicators of those who, in the future, will be more likely to respond to advances in nutrigenomics.

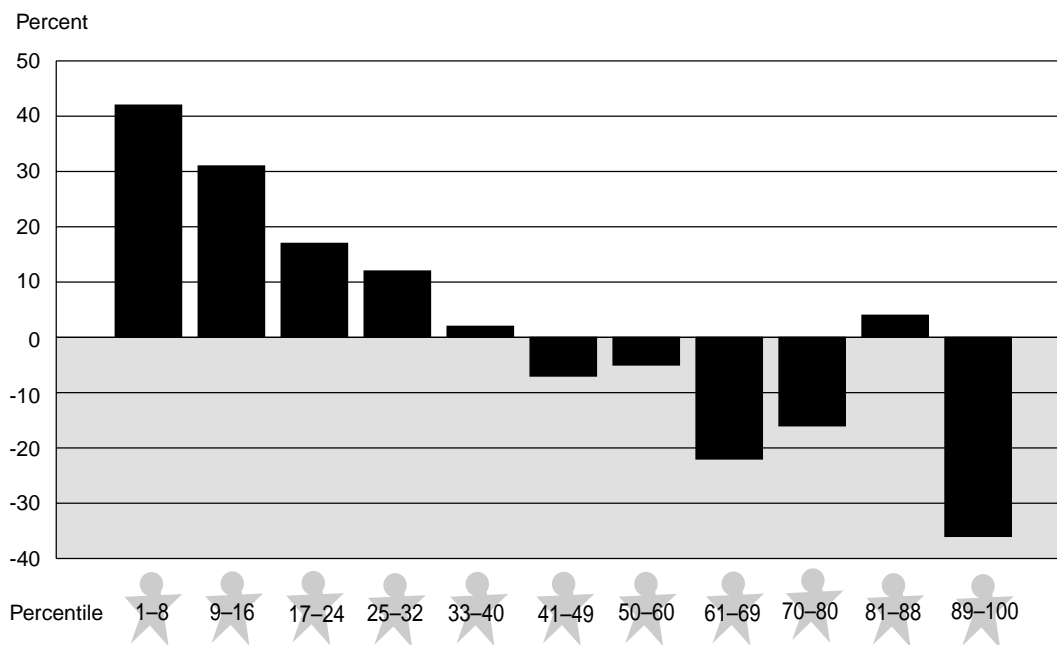
Indeed, our analysis determined that buyers of organic food products are more likely to appear on the left side of the index (see Figure 7-4).

Age and the Consumer Nutrition Index

Not all demographic variables tie nicely to potential nutrigenomic use. Age, for example, demonstrates a tricky level of diversity. The likelihood of any particular age group appearing in a regular distribution across the spectrum just doesn't hold up. Vastly different age groups populate the various segments along the CNI (see Figure 7-5 on page 96). There is a cluster of middle-aged adult consumers who display the heaviest nutrition information usage and strongest behavioral responses, whereas a lot of older adults—many of whom are retired—display moderate information usage but strong behavioral responses (from the 25th to 40th percentiles) and cluster in the low information user, low behavior groups. Young adults are much more likely to respond strongly

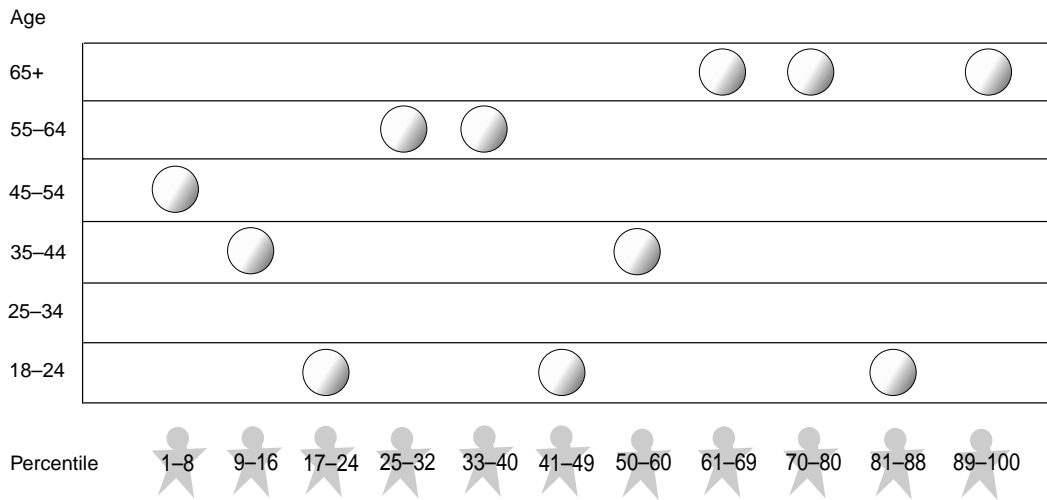
Figure 7-4

*Users of Organic Products May Be Early Indicators of the Nutrigenomics Market
(Increased/decreased likelihood of organic shoppers to fall in ... percentile on the CNI)*



Source: Institute for the Future, NCNG Household Survey, 2001.

Figure 7-5
Age Provides Diversity
(Increased likelihood of member of ... age group to fall in ... percentile on the CNI)



Source: Institute for the Future, NCNG Household Survey, 2001.

with only moderate information (17th to 24th percentiles), to use only a moderate number of sources and change behavior only moderately (41st to 49th percentiles), or to gather information but display very low behavioral change (81st to 88th percentiles).

KEY CONSUMER NUTRITION INDEX SUBGROUPS

Each of the subgroups along the index demonstrates different characteristics based on how much nutrition information its members gather and the way they change diets and use supplements.

**Group 1
 (1st to 8th Percentiles)**

The consumer segment that falls between the first and eighth percentiles gathers nutrition information from a variety of sources and displays the strongest behavioral responses to this new information—they

change diets regularly and use nutritional supplements. They are clearly *experimenters*. They are likely to be women, age 45 to 54, with some college education. They are also the group with the highest share of organic food users.

Group 2
(9th to 16th Percentiles)

Members of the second group differ from those of the first group somewhat. They gather just as much information as the first group, and they change their diets as well, but they do so less frequently. They are more likely to be younger (age 35 to 44) and to be much better educated—this group has by far the largest share of postgraduate degree holders. They are the *sophisticated users*.

Group 3
(17th to 24th Percentiles)

Members of the third group have their own set of characteristics. They are only moderate users of nutrition information, but they are very likely to have made a major diet change recently. The most notable part of this group consists of young adults (age 18 to 24). These are people who are just starting to adapt their diets to adulthood and who, thus, are very likely to have made a recent diet change. They also have less educational attainment because many are still in school or will be going back to school to finish their programs. Overall, this group is *young and interested*.

Group 4
(25th to 32nd Percentiles)

Members of the fourth group are also moderate users of information, but they are more likely to take nutritional supplements than to make major changes in diet. Members of this group are also much more likely to be older (55 to 64), but they are also well educated. They are the *mature moderates*.

The Rest

As we move across the index, the average level of educational attainment falls, as does the use of nutrition information. The likelihood that people on the right half of the index are active in making diet changes or are using nutritional supplements falls as well. These people are not as likely to respond to new information about nutrigenomic products.

CONSUMER NUTRITION INDEX CONCLUSIONS

Two strong lessons emerge from our work on the CNI. First, the likelihood of building a market for nutrigenomics-based products and services decreases the further you move along the spectrum to the right—that is, toward people who have less education and less of a propensity to change behaviors based on the information they receive. Second, even among people who currently do use nutrition information and have made recent adaptations in diet and the use of nutritional supplements, the variety of demographic characteristics and attitudinal patterns of the specific subgroups along the index is significant. This will make it a challenge for any food industry player trying to build a mass-market approach to selling nutrigenomic products (see Chapter 9 for possible strategies for addressing this difficulty).

CORE FORECAST ESTIMATES

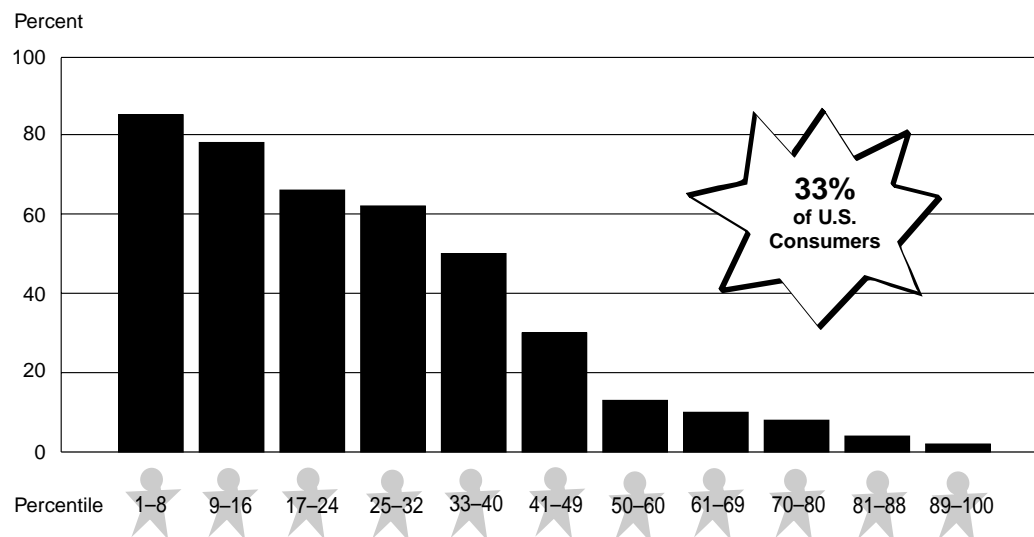
The research group at IFTF worked through each of the subgroups and estimated the share of each specific subgroup's members who would likely be convinced to adopt nutrigenomic products once they received good information about them. We assumed that the current spectrum of interest in nutrition information and behavioral adaptation would reflect a similar interest in new information and a similar likelihood of behavioral adaptation, though we also assumed that the quality of the new information would be much better. In making our core forecast, we utilized information from expert workshops, explorations of the new science, consumer surveys, focus groups, and industry analyses.

Figure 7–6 represents the research team's conclusions: Approximately 33% of the consumer population will be gathering information

in some form from the nutrigenomic advances and will be willing to make lifestyle changes by paying more for products and services that promise to make a difference to their health. The further right we move along the CNI, the stronger the decrease in the likelihood that those consumers will make nutrigenomics-based purchasing decisions in 2010.

Figure 7-6 also provides the specific data that make up this 33% total. While we expect 85% of the experimenters and 78% of the sophisticated users to be in the market for nutrigenomics-based products and services in 2010, only 4% of those consumers on the entire right half of the CNI will be in this market as well. For companies marketing to consumers along the right half of the CNI, nutrigenomics will be tough to sell. As one 63-year-old male new consumer stated: "It's like being ... propelled into the future to look back and see what happens in

Figure 7-6
One-Third of Consumers in the Nutrigenomics Market in 2010
(Estimated percent of each group likely to pay more for nutrigenomics-based products and services)



Source: Institute for the Future, NCNG Household Survey, 2001.

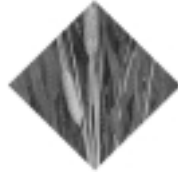
your life, and all the mystery is taken out of it.... I just can't see the purpose of knowing whether I'm going to die at 80 or live to 125, or something like that. I'll just go along and live my life and enjoy it as much as I can ... you know, not risk anything, but just let it travel."

A weighted average indicates an approximately 33% total market potential—people who would be likely to search for information about, and find an added value for their lives in, the promises of nutrigenomics. When we asked an easier question—how many people are likely to experiment with a nutrigenomics-based product during the year 2010?—the answer was markedly different. Taking patterns of behavior today we found that approximately 74% of people would at least experiment with such products in 2010. Nevertheless, the 33% is the more relevant number for businesses interested in the question of how large the nutrigenomics market is likely to be at the end of the decade, since it measures people who are likely to absorb information, calculate its personal value, and be ready to act on that information.

Keep in mind that 33% represents the likely share in 2010, not today. The percentage will grow between now and then. Today, for example, people who regularly purchase organic products (at least most of the time or always when they shop for groceries) represent about 13% of the total U.S. population. In 2010, those regular purchasers of nutrigenomics-based products and services will be about 33%, a growth of more than 150%.

We have determined that the core market for nutrigenomics is about one-third of adult consumers, but several important questions remain about the types of products consumers will decide to buy and what types of information will inform those decisions. Will these consumers use their newfound knowledge of nutrigenomics to purchase only existing products? Or will they be willing to extend their purchasing range to fortified or genetically modified foods? It is this second group of products that will have the greatest transformative effects on the food industry. In the next chapter, we explore just how much that market is likely to change.

FORECAST: THE NUTRIGENOMICS MARKET IN 2010



In this report, we have presented three key findings that will intertwine in the coming decade to create the nutrigenomics market of 2010:

- In the next few years, nutrigenomic science will begin to offer small population groups customized information about the connection between nutrients and long-term impacts on health.
- The existing structure of incentives in the food industry will make it difficult to develop tailored products based on this technology and bring them to market through the regular distribution channels.
- Sophisticated consumers of future nutrigenomics-based products and services—who will make up about one-third of all adults in the United States—will aggressively search for nutrition information, bypassing traditional information channels. They will use the newfound information to change their behaviors.

As a result of these trends, consumer activities will significantly change the food industry. Companies that anticipate this change will be in a position to reap substantial benefits.

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Nutrigenomics consumers in 2010 are likely to pay more for certain foods that enhance their health.

NUTRIGENOMICS CONSUMERS

We have identified a portion of consumers who, by virtue of nutrigenomics, will come to understand the connections between their own genes and the nutrients they consume. Once they understand these connections, they will be willing to act by paying more for certain foods that enhance their health nutrigenomically. We call this group the “nutrigenomics consumers.” We are tracking the steps they are likely to take to get to this point, and the scale of change they are likely to engender.

Behavioral Changes

The information that will become available about nutritional benefits in the next ten years will be voluminous and often confusing. At best, nutrigenomics will be able to begin identifying the targeted benefits of specific micronutrients for population subgroups that share particular genetic characteristics. These benefits might postpone or mitigate some diseases.

In order to act, nutrigenomics consumers will want to get information from several independent sources that confirm the underlying research. They will also want to identify their own genetic compositions by means of genetic testing. In most cases, consumers will change what they eat only slowly, over time, and with much experimentation—as more information becomes available, as the range of products on the market grows, and as food and nutrition choices come to fit into personal and family lifestyles.

Many of the behavioral adaptations to nutrient intake will be preventive and, therefore, the benefits will not be easily measured. We don’t anticipate that all behavior changes will be permanent, but we do think, as we discussed in the previous chapter, that about one-third of adults in the United States will change at least a part of their nutrient intake for at least a portion of the time as a result of the information generated by nutrigenomics.

Stepping Stones

With the information they gather, nutrigenomics consumers will begin moving through the process of adapting what they eat to reap the potential health benefits. Look for nutrigenomics consumers to move relatively carefully through three sequential steps:

- *Choosing among existing products.* The information nutrigenomics consumers gather will either confirm their current food choices or encourage them to make substitutions. For example, they may find confirmation that eating more broccoli or tomatoes is particularly good for their genetic subgroup, because the vegetables contain certain newly discovered phytochemicals beneficial to them. At first, nutrigenomics consumers will look for existing products that have the specific micronutrients that work well with their genetic predispositions. Or nutrigenomics consumers may begin to use processed foods—cereals or grains, for example—that have specific nutrients.
- *Selecting a fortified or enhanced product.* As they begin to learn more about themselves from detailed family histories and genetic tests, nutrigenomics consumers will begin to demand products that combine unique groups of nutrients with special benefits for them and their families. They will increasingly search for specialized products—looking for a new brand of Roma tomatoes that has been developed to carry a specific micronutrient, for example, or looking for a supplement or fortified processed food that has particular phytochemicals. Fortified foods or supplements that contain a combination of nutrients will be of special interest. Genetically modified foods will become attractive at this point, since they will be used to provide tailored enhancements to consumers' favorite foods.
- *Looking for customized products.* As genetic testing improves toward the end of the decade, individuals are likely to demand products that have very specific components. Customized and preordered foods and supplements—natural, fortified, and genetically modified—will increase in scale and desirability.

MARKET RESPONSES

Each of these actions by the one-third of consumers willing to change some of their shopping choices based on nutrigenomic information will have an impact on the existing food and supplement market. Indeed, they will bring about a shift in demand as well as an increase in the potential value that can be added to a range of products.

We would expect to see some of the following market responses at each stage of adaptation.

Choosing Among Existing Products— Produce Is One Answer

The easiest place to see the likely changes to the market will be in the produce section. Since fruits and vegetables are particularly rich in nutrients, many of the early advances derived from nutrigenomic information are likely to be associated with produce already available in stores.

Indeed, consumers are already buying produce to promote good nutrition, and produce is becoming an increasingly high-margin commodity. Today, 12% of grocery store sales and 20% of profits come from produce. In response to this trend, the number of different produce items in a typical grocery store has doubled in the last decade. Look for both the number of produce products and their share of profits to grow at an accelerated rate over the next decade. Also expect changes in the health foods sections, as nutrigenomics consumers search out existing foods with identified nutrients that promise widespread benefits.

Selecting Fortified or Enhanced Products— A Mass Approach Becomes Less Effective

Within three or four years, nutrigenomics consumers will begin to know enough about their own genetic compositions to search actively for foods that are fortified or genetically modified to provide specific levels of micronutrients. But food distribution companies will face real problems. Since specific subgroups of consumers will be looking for different combinations of nutrients, it will be difficult for the health

claims of particular packaged goods to meet the needs of a range of consumers. Rather than emphasize health claims, product marketers will begin to focus on ingredients at a detailed level—they'll list a certain level of lycopene or other particular phytochemicals, for example. It will be up to the consumer, or the store, to relate that ingredient to the consumer's individual needs as a member of particular subgroups, defined by genetic profiles.

Mass merchandising in the food industry—at least to the nutrigenomics consumer—will become much more challenging. Look for smaller stores to emerge that provide specialized products and detailed information. Look for more direct-to-consumer companies that provide tailored foods across much broader geographical markets in order to achieve scale. Special genetic testing centers are likely to emerge to supplement the health care system. Expect company insurance programs to provide incentives for adopting good health and nutrition habits. All of these alternatives will take a significant portion of the food and supplement market away from today's mass-oriented outlets.

Looking for Customized Products:

The Market Fragments as Foods and Drugs Merge

The first two trends will intensify toward the end of the decade, as more individualized adult genetic testing becomes available. Increased testing will further fragment the market, as individuals attempt to find the combinations of micronutrients that seem best for them. Standard ingredient lists on packaged products will help, but their effectiveness will be limited. As a result, small shops doing customized packaging of food products and supplements will grow.

Different foods and supplements may prove effective in controlling appetite and obesity for a wide range of subgroups. Other subgroups will have unique combinations of foods and supplements that deal with their targeted susceptibilities to cancer, heart disease, or arthritis. By virtue of their size, small shops will be able to help customers find information about their individual genetic characteristics and then walk them through the nutritional benefits of each product on a one-on-one basis.

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New alternatives in nutrigenomics will take a significant portion of the food and supplement market away from today's mass-oriented outlets.

As the knowledge of the impact of nutrients on health grows, pharmaceutical products will face inevitable challenges. Look for inroads onto pharmaceutical turf, especially prevention—for example, new phytochemicals are likely to be discovered that could combat obesity, mitigate depression, or lower cholesterol levels for a very particular subgroup. As a result, the FDA is likely to begin running into serious problems distinguishing food and supplement benefits from some classes of drugs. This may slow down the development of the market until the agency can sort things out, perhaps changing the nature of the regulatory system.

MARKET FORECAST

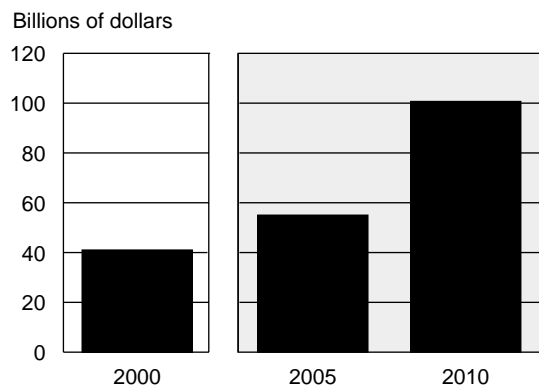
Despite obvious barriers, the market for nutrigenomic foods or supplements will grow rapidly. A series of changes will contribute to the expansion of this new market:

- Natural and organic foods will have the largest initial growth, as certain types of fruits and vegetables are identified to have properties that provide health benefits to people with certain characteristics.
- As knowledge of the efficacy of combinations of nutrients becomes more important, the value of fortified foods and supplements responsive to fairly large genetic subgroups will grow as well.
- Individual genetic testing, which will be essential for understanding the value of specific nutrients, will expand rapidly.
- As valuable combinations of nutrients are identified, there will be a growing demand for genetically modified products with specific amounts of nutrients.
- Nutrigenomics consumers will demand more informative packaging and information services that help them find what they need.
- By the end of the decade, there will be a growing battleground for nutrigenomic products that can replace some of today's drug treatments for moderate cases of such conditions as obesity, high cholesterol, and high blood pressure.

In summary, the market for food purchased for health reasons will take off during the next decade. We anticipate that the total market for such foods and supplements will more than double in size from an estimated \$41 billion today to \$100 billion in 2010 (see Figure 8–1).

The pace of health-oriented shopping will expand over the decade. In the first half it will grow at an annual real-dollar pace of over 7%; during the second half of the decade, it will grow at almost 11% per year. Even with all the growth in healthier foods and supplements, this sector will come to make up only about 10% of the total food and nutrition market, which includes food purchased in restaurants.

Figure 8–1
Focus on Food and Health Will Grow
(Billions of 2000 dollars spent on food and nutrition products bought for health reasons)



Note: We estimate today's market for food and nutrition based on health concerns to include about \$10 billion for natural foods with perceived health properties (about equal to today's purchases of organic and natural foods, although the two are not fully coincident); \$16 billion spent on foods that are enhanced with properties that promote health; and \$15 billion for nutritional supplements.

Source: Institute for the Future; historical data derived from *Nutrition Business Journal*.

In the first half of the decade, then—as nutrigenomic information first appears—more consumers will experiment with nutrition by looking for specific micronutrients in existing products. As time goes on, an increasing portion of health-oriented nutrition products will consist of enhanced foods or newly emerging supplements. Look for the growth rates of both enhanced foods and supplements to be over 10% per year by the end of the decade (see Table 8–1).

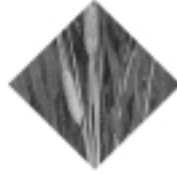
The nutrigenomics market will remain a relatively small share of the total market for food in the United States in the next decade. At some \$100 billion by 2010, however, the nutrigenomics market will offer significant rewards to those companies with the right strategies. We explore some of these possibilities in the next chapter.

Table 8–1
Rapid Increase in Nutrition and Health During the Decade
(Average annual rate of increase in food types)

	<i>2000–2005</i>	<i>2006–2010</i>
Natural foods with health benefits	11	7
Enhanced (fortified or genetically modified) foods	6	13
Nutritional supplements	7	11

Source: Institute for the Future

STRATEGIES FOR SUCCESS IN THE NUTRIGENOMICS MARKET



To take advantage of the nutrigenomics market likely to emerge in the next decade, companies along the food supply chain will have to respond to four strategic imperatives:

- *Research.* Successful companies will need to stay abreast of nutrigenomic research and be ready to respond quickly to the opportunities it provides.
- *Trusted information.* Successful companies will need to take part in, or at least stay close to, trusted information sources, so they can pass on helpful and thorough information about the science of nutrigenomics to their customers, through one channel or another.
- *Distribution.* Successful companies will need to change the way products are distributed to consumers.
- *Marketing.* Successful companies will need to reinvent marketing strategies without forgetting the basics.

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In the new world, brand manufacturers will have to provide products specifically configured for well-defined groups of nutrigenomics consumers.

RESEARCH: UNDERSTAND AND RESPOND

Everyone along the food supply chain must monitor the basic science of nutrigenomics for themselves, so they can react to opportunities as soon as possible.

Range of Products

Brand manufacturers, for example, traditionally have focused on the “D” in R&D, leaving research to universities and the agricultural sector. They spend significant resources on development—formulating and reformulating a new product until it has the right taste, texture, look, and convenience to be a hit. Then they market the product heavily until it has the brand recognition to fly off the shelves.

In the new world, brand manufacturers will have to provide products specifically configured for well-defined groups of nutrigenomics consumers. Instead of focusing solely on marketing to the masses by enhancing brand recognition, the brand manufacturers will have to offer consumers the value-added choices that make that particular product work best for them. By embedding science in their products, brand manufacturers could market what is *in* the product—the value-added science—in addition to the brand name behind it.

Intellectual Property

As companies develop and patent ingredients that enhance the nutritional quality of their food products, we expect these ingredients to be increasingly differentiated. Exclusive rights protection is difficult to attain in the food industry today, however, and we hear over and over how difficult it is to protect food innovation and recoup R&D investment. By participating in the science behind these new ingredients, the brand manufacturers could increase their control over their use.

In this way, brand manufacturers must be careful to protect consumer confidence in the nutrigenomics-based brands they sell. They must also realize that the value of the product is for specific subgroups of the population and not for everyone in the mass market at once. By controlling or participating in the scientific process, the brand manufacturers can be more confident of the validity of their claims. Brand manufac-

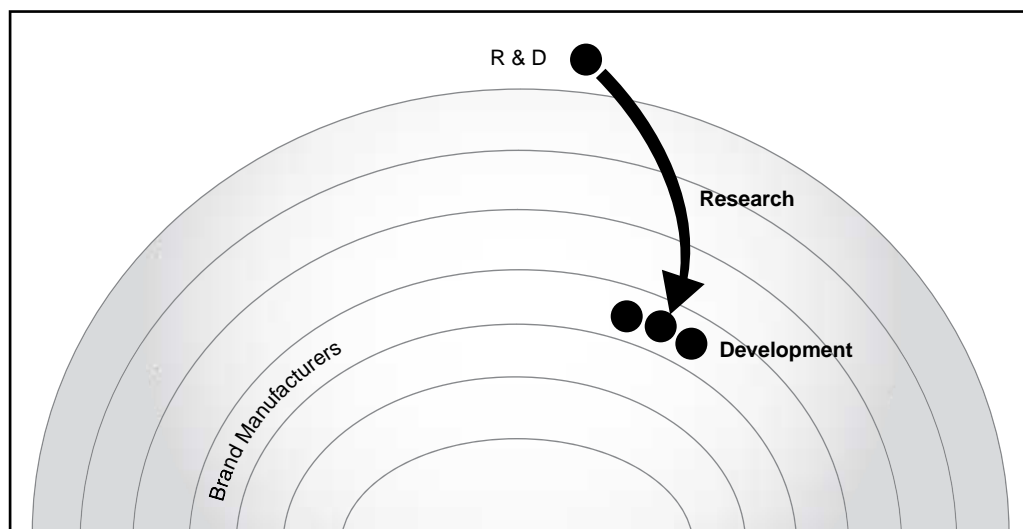
turers may be in the position to reunite research with development and, in the process, transform a growing portion of what they do into a value-added, rather than commodity-based, business (see Figure 9–1).

TRUSTED INFORMATION: BE A PROVIDER

The foundation of the market success of a value-added food supply lies in consumers' trust and confidence in the science behind the products. Consumer trust is hard to earn and easy to lose, but imperative if nutrigenomics is going to revolutionize the food supply chain. Nutrigenomics-based food products promise long-term health benefits, and, in order for consumers to find value in such products, they must believe the health claims.

While our surveys have shown that consumers, particularly skeptical new consumers, tend not to trust information—even value-added information, provided directly by brand manufacturers or retailers—

Figure 9–1
Brand Manufacturers Link the Research with the Development



Source: Institute for the Future

these players can still work to promote and disseminate credible sources of information. Indeed, they must.

Provide the Best Information

Companies should make sure they have the best information on nutrigenomics, and be ready to use that information to drive internal processes. In many cases, the best use of information will be to show the limitations of the promises—that is, the product will benefit only a subgroup of the population if used in conjunction with certain other products. Companies should use good information like this to drive product development, advertising, labeling, shelf placement, target marketing, and budgeting. Trying to extend the market to people who won't really benefit from the product will only alienate those very consumers companies want to attract most.

Increase Transparency

One way of building trust is to increase transparency along the supply chain. New consumers assume that a company only divulges information that displays its products in a favorable light and keeps quiet about everything else. Companies should make clear what the new nutrigenomic products can do—and what they can't—and help consumers find the ones that best meet their needs. Retailing will become a much more information-intensive experience for nutrigenomics consumers, and they will desire clear, objective information sources in stores (e.g., brochures, kiosks, online access, or nutritionists), plus simple labels on the products to help them combat information overload.

Build Coalitions Along the Supply Chain

Even before the consumer learns to trust the science behind a product, brand manufacturers and food processors must trust the science themselves. They can come to do so by facilitating open communication among the various players along the supply chain, which enables R&D to be more focused and applicable. Brand manufacturers, with their knowledge of the development process, and agricultural chemical and biotech companies, with their scientific understanding, can work together to bring valuable, credible products to the consumer more quickly.

Promote “Good Old Trustable” Agents

In the United States, consumers generally trust the regulatory agencies that oversee the food supply. One male new consumer in our focus groups stated: “I’ll listen to [the FDA] ... because it’s impartial.” Another consumer said she would try a new product if its benefits were researched and proven by the “good old trustable FDA.”

Thus, it is in the food industry’s best interests to maintain this level of trust and impartiality, by helping the USDA, FDA, and even the Environmental Protection Agency, among other state and federal agencies, to build large enough staffs of well-trained scientists and other resources to keep up with the rapid changes in the industry. Companies should continue to work with the regulatory agencies to clarify and develop existing regulations until they reflect the state of the new industry. As a result, these agencies will effectively oversee the safety and efficacy of new food products.

Utilize Independent Assessments

Consumers distrust information from parties they believe to have a vested interest in products. But consumer groups like *Consumer Reports*, health and nutrition newsletters with the sponsorship of Harvard, Tufts, and the University of California at Berkeley, and a number of new Web-based health and nutrition initiatives provide independent assessments of the quality of information about nutritional products. Companies should monitor what they are saying, learn how they assess claims and products, and provide them with the best information they have about ingredients, processing, and labeling.

All of the players along the food supply chain have an interest in promoting trust with the consumer. Companies should consider working with consumer or advocacy groups and other independent evaluators to agree on standards and criteria for safety and efficacy. Actively promoting openness in the form of independent assessments is a very important step in getting new consumers to feel companies have their best interests at heart.

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It is in the food industry’s best interests to maintain a level of trust and impartiality.

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Nutrigenomics
will be built on
the foundation
of some of the
most intimate
knowledge of
human beings
imaginable.

Protect Consumer Privacy

Nutrigenomics companies must earn their customers' trust in another important area—privacy protection. When asked to think about their genetic profiles and what concerns they would have regarding that information, consumers in our focus groups thought of privacy. Indeed, “invasion of privacy” was a common first response. One 29-year-old male new consumer stated: “[Genetic profiles have] the potential for a lot of good or a lot of bad. It depends on who has their hands on that knowledge. I’m not saying that that knowledge in and of itself is bad. But it depends on who and why they’re using it.” Consequently, in developing and marketing nutrigenomics-based products and services, companies must appreciate consumer sensitivity to privacy.

Nutrigenomics will be built on the foundation of some of the most intimate knowledge about human beings imaginable—the very genes that make them who they are and determine the diseases to which they may be predisposed. Companies that have any contact with that information—especially testing companies, but also food companies using that information to develop products—will have to make sure that the information is used appropriately and that there’s no chance of its getting into the wrong hands. People who provide advice to individuals will have to be sensitive about balancing the individual’s vulnerability about revealing personal information with their need for more information in order to give a more targeted response. Even one or two high-profile cases involving the misuse of genetic information could set market growth back by years.

DISTRIBUTION: HELP CONSUMERS EXPERIMENT

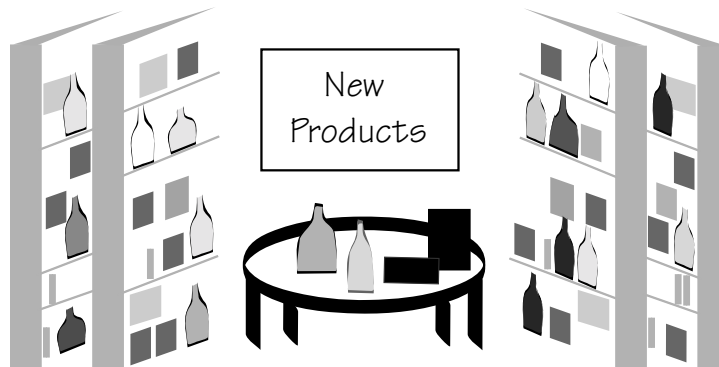
Consumers will be hit with vast amounts of information about the benefits of change in the food industry. But it will be hard for them to assess what will be really useful. Companies along the food supply chain should help consumers sort through the information by enabling them to experiment. This strategy will involve changing how products *and* information are distributed to consumers.

Change the Stores

With an increasingly fragmented consumer market and new value-added products, getting the right information to the right consumer at the right time becomes more challenging. The retailer—with its powerful consumer database and regular presence in the consumer's life—could become a locus of new product trials and more targeted nutrition information. Several retailers are experimenting with these ideas already, by opening up special areas of their stores for new products, giving tours to consumers with special nutrition needs, creating an information center inside the store, and reorganizing displays to focus on particular nutrition concerns (see Figure 9–2).

We expect to see more experimentation like this across the retail sector. For example, kiosks distributed throughout the store could offer up-to-date nutrition information about particular foods or supplements for specific population subgroups. The databases in these kiosks will be much richer than those offered today. When retailers receive new products, all with a particular ingredient or benefit, they could assemble the scientific research behind them and put together an information packet for the consumer, along with a description of the products and where to find them in the store.

Figure 9–2
Experimental Shelves



Source: Institute for the Future

Or retailers could create a “store-within-a-store,” where the consumer can browse among the products of the latest research, try new products, easily locate the products beneficial to his or her genetic profile, and talk with a dietitian. Much of this research material could also be Web-based, enabling the new consumer to access it from home. Sophisticated consumers could go as far as building protected Web pages to house their genetic information and lists of recommended foods specifically tailored for them, and which could also be accessed at an in-store kiosk for easier shopping. All of these innovations will significantly increase the added value for new consumers, making their supermarket a more valuable source of information *and* value-added products.

Develop a New Information Source

For the nutrigenomics revolution to take hold, however, information dissemination can't be left to the retailers alone. The scientists must get involved as well. Research scientists typically publish their findings in peer-reviewed, specialized journals, designed for an audience with a strong scientific background. These journals are a very important resource in the scientific community, but are difficult for the lay public to understand. Since new consumers typically desire and search for credible information, perhaps scientists, whether in universities or companies, would do well to distill their research findings into shorter documents designed for a general audience and post them on university Web sites, or distribute them to media outlets.

In fact, universities and companies could provide incentives for scientists to do so, including funding, promotion, and salary criteria. Although the information is likely to be disseminated through other information flows as well, such as community Web sites, the mass media, and information centers in retail stores and other places, such incentives to scientists will encourage new information to reach consumers as directly as possible.

MARKETING: DON'T FORGET THE BASICS

Many functional food products have failed thus far because companies forgot some of the marketing basics. Products were introduced before the nutrition research was complete, with medical-sounding names, confusing health benefits, poor product placement, and high prices. As companies consider offering new products, it is important to remember the basics of food development and marketing, while also adapting to the new, fragmented market of the nutrigenomics consumers.

Provide Multiple Benefits in a Single Package

Consumers in the future will still want taste, convenience, and good prices for their food, in addition to nutrition. Even nutrigenomics consumers will want these multiple benefits in a single food, although they will add personalized nutritional benefits to the list.

In a recent *Food Processing* survey, R&D managers discussed the latest food trends. Spicy, flavorful foods will be in demand for baby boomers with dulling taste buds, and ethnic foods will continue to grow in popularity to meet the needs of an increasingly diverse population. These trends should be combined with the fruits of the nutrigenomics revolution. R&D efforts should be integrated to offer, for example, flavorful foods with nutritional benefits as well as fortified ethnic foods.

Carve Out Value-Added Market Niches

While producers shouldn't forget the basic food preferences of their customers, they can't rely on the traditional mass-marketing model to reach the nutrigenomics consumer. The fragmented market requires a targeted, multichannel approach to reach specific populations. Companies must experiment with reaching the consumer in new ways.

Producers should work with retailers to solve problems of product placement, for example. If the new products are put in a special nutrition section, consumers may overlook the section. If the new products are placed on the shelves with similar products that aren't nutritionally superior, the products will be evaluated by price (and risk losing out, since they will be more expensive). Clearly, innovative placement so-

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“I like taste, but also I pick [foods] that are nutritious for me. I have a 4-year-old son, and sometimes he likes certain things, and that's taste. And I look for nutritional value for him, too, but there's also sale prices. So it's more than one category ... for me.”

—A 34-year-old female new consumer on how she makes purchasing decisions

lutions will be needed. For example, retailers could try placing new products around or in the produce section, since those consumers who purchase produce often are increasingly likely to purchase nutrigenomic products for their added nutrients and personalized benefits. Web-based, catalog, or other multichannel strategies may also work well, to allow consumers to get their nutritionally superior products in the way they choose. Remember that in a world with more value-added products, efficiency should not always drive space use.

Our household surveys and focus groups indicated that several players may be crucial in driving behavioral change and carving out value-added market niches. Doctors continue to be one of the most trusted sources of information. Thus, they need to be made a part of the nutrigenomics revolution by being convinced continuously of the value of nutrition and prevention. Health insurance packages can be restructured to reward people who adopt healthy new diets based on doctor recommendations.

CONCLUSION: NO SINGLE DIET REIGNS

As we've seen, the fundamental benefit of nutrigenomics is an improved understanding of the role diet plays in an individual's health. Based on the genetic profile of an individual, science eventually will be able to recommend a customized diet to maintain health and prevent disease. Consumers in the future could take advantage of what nutrigenomics offers by using the traditional food supply: adjusting their diets based on foods that are already available. If mangos, for example, are good for their genetic profile, they'll buy more mangos—they won't have to be better, healthier, nutritionally enhanced mangos.

But the supply chain is composed of a diverse set of players, and it is very likely that particular players will develop and offer improved foods or supplements based on scientific research. Already, scientists at the University of Newcastle in Australia have developed a pill made from broccoli's known cancer-fighting compound, indole-3-carbinol. Other examples using genetic modification will arrive rapidly as well—including, for example, high-protein corn or soy oil with increased nutrients and decreased levels of saturated fat. The food industry is in

the midst of transformation from a low-margin, commodity-type market to one with information-driven, differentiated products with high value-added potential. By understanding and working with those consumers interested in the connection between food and health, companies will be able to use nutrigenomics to create a market that offers a range of product options. Information will be a critical component of success, both in building new product lines and in helping consumers understand and work with the system in their own interest.

Nutrigenomics will create ranges of new products and new services that will increasingly blur the boundaries between health care and food. It will present a clear threat to those in the industry who continue to operate in the ways that have been so successful in a mature, low-margin business. Those companies that can respond to the personalized concerns of a growing number of sophisticated consumers will be rewarded by a growing market for value-added, highly differentiated products, driven by the nutrigenomics revolution.

