Health & Living

SPECIAL ISSUE:

Glyconutritionals
Good Health's "Missing Link"

No Getting Around It—
You Need Glyconutritionals
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Great Glutathione!
Boost Your Key Antioxidant
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The New Era is Underway
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MANNATECH
JUNE 2003 • V3, N6

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Health & Living

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MANNATECH

The Impact of Glyconutritionals

In this special edition of *Health & Living*, we're focusing on glyconutritionals—why you need them, where they come from, how they work and what they can do for you.

Glycoscience, which started in the 1960s, is a term that encompasses all of the specialties of glycobiology, the branch of science that studies the role of sugars in living organisms. As a result of this new scientific research, glyconutritionals have been developed. Mannatech's glyconutritionals are designed to provide the carbohydrates people require for cell-to-cell communication and optimal health to cells quickly and in sufficient quantity. These carbohydrates are also known as "sugars" or "saccharides."

Plant saccharides (or sugars) are a source of energy and serve vital structural and functional roles in the human body. Research shows that eating fresh, unprocessed plant foods that have saccharides is strongly related to numerous health benefits.

Substantial scientific data reveals that our bodies have become increasingly vitamin- and mineral-deficient.* We have also learned that our modern diet may be lacking in some necessary sugars. Americans get plenty of table sugar (sucrose) and high-fructose corn syrup—actually far too much, contributing to the current epidemic of excess weight gain. But we don't even come close to consuming enough of the necessary plant saccharides we need to support optimal health.

Almost daily, new scientific evidence shows that people can benefit from nutritional supplements, including glyconutritionals. The more we learn about nutritional saccharides, the more we see how really important they are to good health. ■

*Fletcher, R. H., and Fairfield, K. M. "Vitamins for chronic disease prevention in adults: Clinical applications." *JAMA*, 2002 Jun 19; 287: 3127-3129.

To understand glyconutritionals and how they relate to the science of glycobiology and glycomics, the best place to start is with some brief definitions:

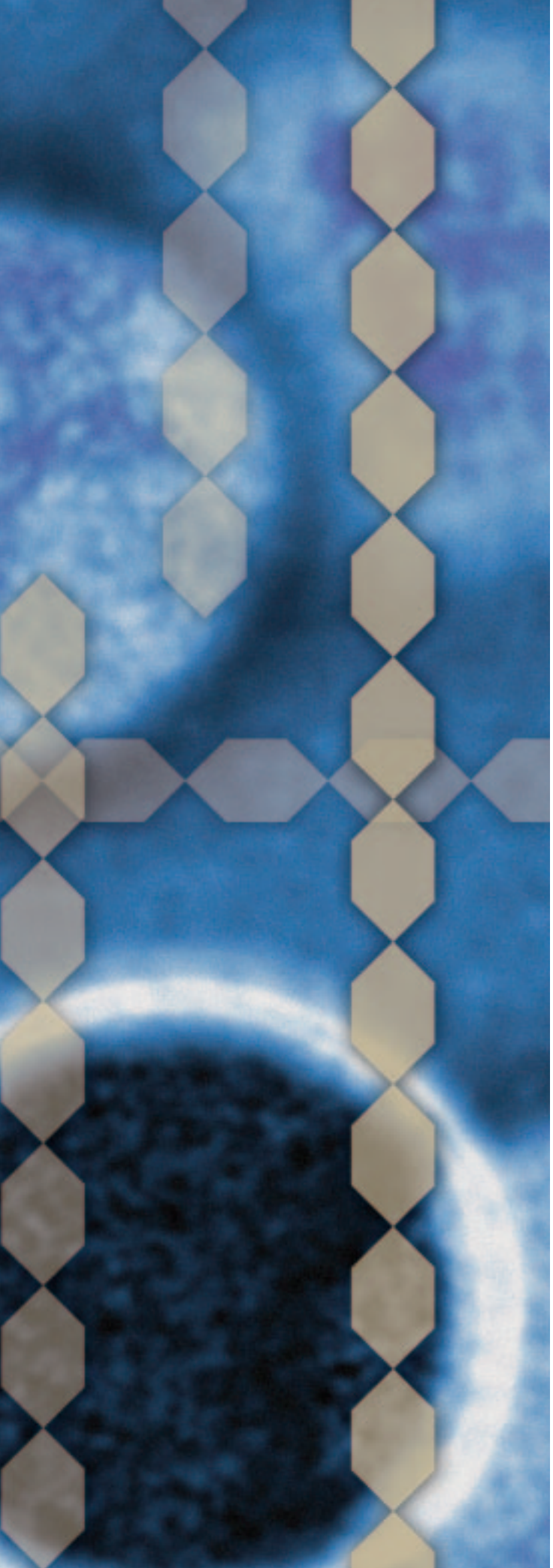
First, the prefix "***Glyco***" is derived from the Greek word meaning sweet.

- **Glycomics** is the total body of knowledge about sugars and how they function.
- **Glycobiology** is the study of how sugars impact living systems.
- **Glycoscience** is a term that encompasses all the specialties of glycobiology.
- **Glyconutrients** are natural plant sugars.
- **Glyconutritionals** are products that contain glyconutrients.

Choose Optimal Health

Glyconutritionals—such as Mannatech's internationally patented Ambrotose® complex—are dietary supplements that contain nutritious, natural plant sugars.

Mannatech glyconutritionals are designed to supplement nutritional requirements and support health—not to diagnose, treat, cure or prevent any disease. The information in this special issue of *Health & Living* is not intended to substitute for a doctor's care or for proven therapy, but to help expand your general level of nutritional knowledge. Then, you will be able to make the best possible decisions about how you, your family and friends can enjoy the benefits of optimal health and a wonderful quality of life!



Your Body's "Must Have" Nutrient

Most of us have been taught that we need only three groups of nutrients to maintain proper wellness. Traditional nutrition education taught that we not only had to eat right, but we also had to make sure we consumed sufficient essential vitamins and minerals, plus essential fatty acids and amino acids.

However, we now know that we also need glyconutrients, since they are essential to cell-to-cell communication and immune system support. Without cell-to-cell communication, immune function is impaired. We can read and hear about vitamins, minerals and herbals all day long, but without optimal cell-to-cell communication, none of them can work effectively.

Much scientific data now exists about the various areas of glycoscience. Research findings have been published in respected publications—from highly technical, peer-reviewed international journals like ***Acta Anatomica*** to the pinnacle of success when it comes to scientific publication—***Science***, the official journal of the American Academy of Science. Glycobiology and carbohydrates were the major topics of the March 2001 issue of ***Science***.

Glyconutrients—First on the "Most Wanted" List

We have learned that glyconutrients are far more important than any other kind of dietary supplement. Every cell in every system of every human organ requires these eight saccharides. Evidence suggests that glyconutrients are the only dietary supplement that can be supportive and helpful in virtually every function of the body.

In addition, glyconutrients have been scientifically shown to work as immune modulators rather than immune stimulators—making them ideal for a person's immune system regardless of individual health issues.

Good Health's "Missing Link"

Compelling new evidence shows that consuming dietary saccharides can result in numerous health benefits. While science has only begun to understand the body's use of saccharides, we've already learned some very intriguing facts.

Probably the most important fact revealed so far is that optimal human health requires the glyconutrients that are found in plants. Glyconutrients may be the virtual "missing link" between what we eat and what our bodies need for optimal health.

The saccharides in glyconutrients are very different from common table sugar since the body uses them for many important functions beyond energy production.

Of course, few of us don't know that Americans already eat far too much sugar—in fact, about four times the recommended daily limit for added sugars. However, these sugars are primarily high-fructose corn syrup and table sugar, or sucrose, which is very different from the essential saccharides.

In addition, the exploding obesity problem in the U.S. and its connection with refined carbohydrate consumption is forcing us to reconsider whether bread really is the "staff of life". Most of us eat far too many refined carbohydrates, primarily in the form of refined breads, pastas, cereals and other baked goods. These foods are rich in starch (a polysaccharide composed entirely of glucose molecules).

To understand the potential consequences of not eating properly, let's consider four reasons everyone (yes—*everyone*!) can benefit from glyconutritionals:

1 *Our bodies were designed for much higher levels of saccharides than most of us get.*

We're virtually genetically identical to our hunter-gatherer ancestors, and we're designed to eat the kinds of foods they ate. Studies show that our ancestors had no access to the foods that are our key saccharide sources today—refined sugar, milk (beyond infancy), breads and pastas. These foods primarily supply three saccharides—glucose, fructose and some galactose. What did our forebears eat? Forty to eighty percent of their foods came from plant sources, including a wide variety of roots, beans, seeds, nuts, tubers, fruits, flowers and edible gums. Their diets included about 100 grams of polysaccharide fiber daily. Today, however, we generally consume less than 14% of this amount.

2 *Very few people eat enough fresh fruits and vegetables.*

Plants are the ultimate source of saccharides. They use the energy from sunlight to convert carbon dioxide and water into sugars. The number and complexity of saccharides found in fruits and vegetables is staggering—so large, in fact, that the total number is unknown. These include the components of both water-soluble and non-soluble polysaccharide fibers that give structure to the plant cell. These fibers typically contain glucose and fructose, but can also contain various monosaccharides, including galactose, mannose and xylose. Since we do not consume enough fresh fruits and vegetables, we get fewer plant saccharides in our diets than we need to sustain good health.

3 *Fresh fruits and vegetables have significantly lower saccharide content than they did as recently as 30 years ago.*

Detailed saccharide analyses were not performed on fruits and vegetables 50 years ago, so very little data are available on their saccharide content. But we do have ample research data that clearly shows that today's fruits and vegetables are not as nutrient-rich as they were as recently as the early 1970s. The reasons for this significant depletion include less nutrient-rich soil, more pollution, wider use of chemical pesticides and fertilizers, and premature harvesting that brings fruits and vegetables to market before they have had time to reach their natural peak of nutrition.

4 *Cooking and processing deplete foods of their saccharide content.*

Research has produced overwhelming evidence that fresh, unprocessed fruits and vegetables are the most nutrient-rich. Nutritionists have measured the quantity of only a few nutrients in cooked or processed foods since these analyses are both difficult and expensive. Instead, they've focused primarily on nutrients where deficiencies are widely recognized. For example, vitamins C and B_1 (thiamine) have been studied at length. Part of the reason these vitamins are vulnerable is that they're water-soluble and therefore prone to losses when foods are chopped, washed or cooked in water. Nutrition scientists generally believe that if these vitamins are depleted, other important nutrients may also be at risk.

Glyconutrients—The Basics

While scientific understanding of how the human body uses saccharides is still far from complete, researchers have already made significant progress in understanding how saccharides affect normal cell function. We also know that most of us today consume inadequate amounts of plant saccharides, which are important not only as an energy source, but also for the structural and functional roles that they play within our bodies.

The need for glyconutrients can be summarized with four concise statements:

- *Proper cell-to-cell communication equals function.*
- *Proper function equals wellness.*
- *Incomplete communication equals dysfunction.*
- *Dysfunction equals disease.*

It's just that simple! ■

Bill McAnalley, PhD

"Our big market is teaching healthy people how to stay healthy and vital to a much older age by showing them that Mannatech products are designed to support their overall good health," says Mannatech's Chief Science Officer, Dr. Bill McAnalley.

In 1978, Dr. McAnalley received his PhD in Pharmacology and Toxicology from the University of Texas Health Science Center, Dallas, Texas. He worked as a toxicologist for the U.S. Environmental Protection Agency (EPA) and was Director of Research at Carrington Laboratories from 1985-1995.

Dr. McAnalley is the principal inventor on over 66 patents that have been issued worldwide, including use and composition of matter patents.

Mannatech

The Natural Leader

Mannatech was one of the first companies in the world to recognize the importance of natural, food-based sugars in the diet—and to provide these sugars in the form of easy-to-take, cost-effective supplements. We were also the first company to apply for international patents on the results of our nutritional glycomics research.

In addition to our role as pioneer and innovator, Mannatech remains in the vanguard of the dynamic, exploding glycomics industry. Most of the glycomics research currently underway elsewhere is focused on synthetic, non-food sugar structures. This fact explains why so much current glycomic research is being sponsored by the major drug manufacturers. Many scientists believe that glycomic drugs will be the drugs of the future, and much pharmaceutical company research is pointed to achieving that end.

Fortunately, we aren't waiting for the results of this research before giving our bodies the support the eight essential sugars can provide. Mannatech products containing Ambrotose® complex offer these sugars (very different from table sugar) in their natural form. The saccharides in Ambrotose® complex are harnessed from rich plant sources and delivered in easy-to-take glyconutritional supplements.

At Mannatech, we've been offering glyconutrient-based products with Ambrotose® complex since 1996. The essential saccharides in Ambrotose® complex allow greatly enhanced cell-to-cell communication and significant immune system support to help you stay at your highest possible level of wellness, which includes the proper functioning of your glands and organs.*

Most experts agree that the future of glycomics will be huge.

In some ways, it seems as though much of the scientific world is just now catching on to a major health-support concept that Mannatech has known about and been bringing to the consumer market since the company was founded. Many of the same "experts" who originally questioned the legitimacy and value of glyconutritionals are now investing millions into what they perceive as one of the most significant health industry opportunities in decades.

Exploring Life's Sweet Side

Always at the forefront of our industry, Mannatech takes (and has always taken) a nutritional approach to glycomics. Our products harness naturally occurring sugars from plants that can support normal body structures and functions in order to sustain health.*

The new interest and research in glycomics by drug companies will most likely benefit Mannatech. Why? Because as glycomics research gains momentum and attracts greater public attention, overall awareness among health professionals will increase. They will learn that glyconutrition is real, legitimate, effective and here now. In addition, health professionals will likely become more interested in the impact of nutrition on health—particularly glyconutritional supplements.

Healthcare professionals may become much more adept at diagnosing disease and able to see illness at the most basic, molecular level, before any symptoms or abnormal test results are shown. Drug development will let doctors intervene and slow or correct the disease process. A whole new class of glyco-drugs—all disease-specific—will reach the market.

At Mannatech and other visionary companies in the dietary supplements industry, we'll be able to develop nutritional products that meet individual needs, custom-tailored to an individual's specific requirements at any given time. Since human nutritional needs sometimes vary (for example, during times of stress), we can focus on discovering what our diet lacks so that we can furnish it immediately to sustain wellness and prolong the healthy period of life.

The biggest impact of glycomics research may be in helping us to understand how to be and stay healthy, how to measure health, and how to optimally support the body at the cellular level.

The future of glyconutritionals is very promising indeed. The wellness industry has been forecast by noted economist and futurist Paul Zane Pilzer to reach $1 trillion by the end of this first decade of the 21st century.

Mannatech will continue to lead the industry, developing and bringing better health solutions to people around the world. ■

*This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.

CAN GLYCOMICS CHANGE THE WORLD?

Glycomics Highlighted in MIT Publication

The prestigious Massachusetts Institute of Technology (MIT) describes the burgeoning science of glycomics research on sugars and their impact on human health as "one of the ten technologies that will change the world."

While mainstream scientists have recognized and are investigating the potential of synthetic glyco-drugs, their efforts may require years to produce results. But the increased interest in the role of sugars in human health can expand the market for glyconutritional supplements today!

In the February 2003 edition of *Technology Review,* the Massachusetts Institute of Technology profiled the science of glycomics as a new technology that "…could have an impact on health problems ranging from rheumatoid arthritis to the spread of cancer cells." Glycomics is the study of sugars and includes glycobiology—the study of the effects of sugars on living organisms.

The article detailed at least six scientific experts who are hard at work, trying to synthesize the thousands of sugars made by the human body. These researchers are funded mostly by pharmaceutical companies that hope to turn these sugars into drugs that will boost the immune system and heal disease.

"The reason for the excitement around glycomics is that sugars have a vital function in the body," the article explained. "By manipulating…sugars themselves, researchers hope to shut down disease processes, create new drugs and improve existing ones."

Not an Easy Task

The article also explains that because there's no simple "code" that determines sugar structures, the researchers admit they have an enormous task ahead. They estimate that as many as 40,000 genes make up each person, and each gene can code for several proteins. In fact, sugars modify many of these proteins. Then various cell types attach the same sugars in different ways, forming a variety of branching structures, each with a unique function.

Researchers say that it's a nightmare to figure out. In fact, a group of more than 40 academics from a number of disciplines called the Consortium of Functional Glycomics is working with a $34 million grant from the National Institutes of Health to accomplish the task. But even with this hefty federal funding, the scientists admit they won't be able to detail every sugar in the body. That, they say, will likely take many years of difficult research. ■

Glyconutrition
Sparking a Revolution

1952
Cancer, Lushbaugh
Tests using radiation burns on rabbits concluded that only fresh aloe gel healed the burns. Week-old aloe gel had no effect.

1970
<500 papers published on glycobiology

1980
~1500 papers published on glycobiology

1990
~4000 papers published on glycobiology

February 1991
Capitalizing on Carbohydrates
Discovery: *"Almost without exception, whenever two or more living cells interact in a specific way, cell surface carbohydrates will be involved. Complex carbohydrates are essential in the correct functioning of the body's immune defenses."*

April 1992
Acemannan Stabilized—active component in aloe gel

1990s
Journal of Glycobiology established by Oxford University. In less than 10 years, the science of glycobiology had exploded to become one of the "hottest" new fields of medical and nutritional research.

1994
Mannatech
established in Dallas, Texas

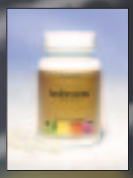
1994
Nobel Prize to UTSW for work on glycoproteins (cell-signaling molecules)

1995
Nature
Cell surface sugars are necessary for recognition and immune function.

August 1996
Initial filing with U.S. Patent Office by Mannatech for its composition and use patent for glyconutrients (Ambrotose® complex)

1996
***Harper's Biochemistry,* Vol. 24**
Identified 8 sugars needed for cell-to-cell communication

November 1996
Ambrotose® complex introduced to the U.S. consumer market



The greatest part of the story of glycobiology and its milestones has yet to be written. By any standard, glycobiology is a very young field of science, but one that has already captured the attention (and research dollars!) of several major segments of the huge worldwide health industry. The coming decades should witness a proliferation of important scientific breakthroughs and other notable achievements in this promising, rapidly expanding area of health applications and business opportunities.

March 2000
GlycoScience.com
goes online

2000
Newton Graphic Science magazine—features the science of cellular messaging

March 1998
Acta Anatomica *"The last decade has witnessed the rapid emergence of the concept of the sugar code of biological information: indeed monosaccharides represent an alphabet of biological information similar to amino acids and nucleic acids but with unsurpassed coding capacity."*

September 2001
Australian patent issued to Mannatech

April 2001
Singapore patent issued to Mannatech

Fall 2001
GlycoScience.com wins **www. Award**

2000
>8000 papers published on glycobiology

April 1998
South Africa issues the world's first patent for a glyconutritional formula

March 2001
Science story—"Carbohydrates and Glycobiology"

December 1999
The Antioxidant Miracle story—"More than 70 percent of Americans will die prematurely from diseases caused by or compounded by deficiencies of (antioxidants)…It is virtually impossible to get the optimal amount of antioxidants through food alone."

May 2001
New Zealand patent issued to Mannatech

December 1998
In a December 1998 study, healthy humans were given radioactively labeled galactose, mannose or glucose. This study showed that galactose and mannose were directly incorporated into human glycoproteins without first being broken down into glucose. These scientists concluded that specific dietary sugars could represent a new class of nutrients.

June 2002
European nations of France, Germany, Ireland, Italy, Liechtenstein, Spain, Switzerland and the United Kingdom issue patents to Mannatech

Spring 2002
Australian Journal of Chemistry devotes a special issue to carbohydrate research.

December 2002
cam article titled "Glyconutritionals: Implications in Rheumatoid Arthritis"

February 2003
M.I.T. Technology Review
story—"Glycomics—One of 10 New Technologies That Will Change the World"

June 2002
JAMA
"Most people do not consume an optimal amount of all vitamins by diet alone…It appears prudent for all adults to take vitamin supplements."

May 2003
Hong Kong patent issued to Mannatech

April 2002
The Scientist
story—"Glycobiology Goes to the Ball"

January 2003
Newsweek
A proposed version of the new USDA food pyramid will recommend that most adults should take a daily vitamin.

March 2003
Mexico patent issued to Mannatech

October 2001
NIH grants $34 million to consortium studying cell-to-cell interactions

July 2002
Scientific American story—"Sweet Medicine: Building Better Drugs From Sugars"
"Sugars modify many proteins and fats on cell surfaces and participate in such biological processes as immunity and cell-to-cell communication. They also play a part in a range of diseases, from viral infections to cancer."

October 2002
New Scientist Archive
"This is going to be the future," declares biochemist Gerald Hart of Johns Hopkins University in Baltimore. "We won't understand immunology, neurology, developmental biology or disease until we get a handle on glycobiology."

"Glyconutritionals Will Be Revolutionary."

We caught up with Dr. Stephen Boyd, Mannatech Medical Director, Department of Health Sciences, to get his take on the "new" science of glycomics. Not a very big surprise. Mannatech scientists have been doing similar research for over *10 years!* He says this new national focus on glycomics has the potential to make Mannatech a household name.

Q: Dr. Boyd, is glycomics the same as glycobiology? Is the research outlined in the MIT article the same type of research Mannatech conducts?

A: Glycomics is the total knowledge about sugars and how they function. Glycobiology is the study of how sugars impact living systems. That means how they affect biological structures and contribute to health in living beings. Most of the researchers in the glycomics field are trying to create synthetic sugar drugs that fight disease. At Mannatech, our research is centered around how these sugars in their natural form impact normal biological processes and the best ways to offer them as supplements. We're not fighting disease, we're sustaining health and wellness—a different approach entirely.

Q: Mannatech first offered Ambrotose® complex to the world in 1996. Will this new glycomics research ever compete with Mannatech?

A: Mannatech was one of the first companies in the world to recognize the importance of natural, food-based sugars in the diet—and to provide them as supplements. We were the first to apply for international patents on the results of our nutritional glycomics research. Most researchers you hear about today won't be competing with us because they're focused on synthetic, non-food sugar structures and how they relate to disease processes. They want to create a new class of drugs—glycomic drugs. That's why much of this research is sponsored by the major drug companies. They know that glycomic drugs will be the drugs of the future.

These drugs will be extremely expensive. Because they are synthesized, it will cost hundreds of millions of dollars to develop them. We, on the other hand, take a nutritional approach to glycomics. We want to harness naturally occurring sugars from plants that support and sustain normal structures and functions in order to sustain health. Our sugar supplements are natural and cost-effective. That's because natural sugars already exist—we're just looking for even more effective ways to put them into convenient, easy-to-take supplements.

Q: Glycomics drugs that heal diseases sound like a good idea. Why go to the trouble of eating right or taking supplements?

A: There's one very important point to remember: Drugs are not natural—they are synthetic. They have never been part of our food chain. All drugs are potentially toxic, including glycomic drugs. They might get you over an illness, which is good, but they don't create health. There is no drug for health. If you want health, you must create, protect and sustain it. Glyconutritional supplements are a key ingredient in this process.

Q: Will all of this new attention to glycomics help or hurt Mannatech?

A: It will undoubtedly help us. As glycomics research starts to increase and gets more attention, it will raise awareness among health professionals that glyconutrition is real and legitimate. They'll soon become more interested and open to the nutritional impact on health, particularly glyconutritional supplements.

Q: Describe the future of glycomics. What can we expect to see in 25 years?

A: It's going to be huge. First, we'll be much better at diagnosing disease. We'll be able to see illness at the molecular level—long before you feel any symptoms, see an abnormal test, or detect it by any currently available technology. Drug development will allow doctors to intervene and slow or correct the disease process. A whole new class of "glyco-drugs"—all disease-specific—will be on the market. Finally, we'll be able to develop nutritional products that meet individual needs—they'll be custom-tailored to your specific needs at any given time. Since your nutritional needs change, for example, during times of stress, we can discover what your diet lacks and furnish it immediately, so that you can sustain health and wellness and prolong the healthy period of your life. The enormous impact will be in helping us to understand how to create and sustain health, how to measure health, and how to detect disease long before we can now become aware of it clinically. It will be revolutionary! ■

Stephen Boyd, MD, PhD, FRSM

"When I was in practice, I was always puzzled and bothered by the fact that insurance companies and health care entities were willing to pay out so much money for a bypass operation when it would have taken so little to prevent the bypass in the first place. It's very enjoyable to be a part of a company that's trying to find those answers." So says Stephen Boyd, MD, PhD, FRSM, Mannatech's Medical Director and Administrator, Department of Health Sciences.

Dr. Boyd completed his BS and PhD degrees in Chemistry at the University of Glasgow, Scotland. In 1974, he graduated with an MD degree from the University of Toronto, followed by training in family practice.

In April 2001 in London, Dr. Boyd was honored by being elected a Fellow of the Royal Medical Society.

"My secret for feeling good? Mannatech!"

There's feeling "okay", and feeling "not bad", and even feeling "pretty good." But none of these compare to true optimal health, as enthusiastic Mannatech product users tell virtually everyone they know. In fact, some simply can't contain their enthusiasm!

"When you're pushing yourself to greater and greater challenges, you need all the help you can get. I'm so glad that I was introduced to SPORT," says Brent Weigner, international ultra-marathoner. He continues, "We're all looking for an edge. When you finally find one, you certainly consider yourself fortunate."

Deborah Huber recalls, "I feel terrific and have a wonderful sense of well-being. I can't thank Mannatech enough for these amazing products that have made such a difference in my life!"

Terry Kipling is certainly a big fan of Mannatech products. "I just had to tell everyone I knew about the difference Mannatech products were making in my life," he says.

"I would have to say that finding Mannatech products has been like getting a new lease on life," explains Fred Franke. "I guess I didn't realize just how good I really could feel. I'm pleased to be able to say that I now feel better than I have in many years. I love it when people ask me my secret for feeling so good…being so happy. I simply say, 'Mannatech!'"

"My experience with Mannatech products has been so wonderful," says Hans Haskell with a big smile. "Clearly there is nothing else like them. My only regret is that I didn't discover them sooner."

"I can truly say that Mannatech opened a whole new world for me," exclaims Diane Chapman. "It started with a bottle of PLUS. I didn't quite know what to expect, but I can tell you my life has been different ever since. And what a difference! I'll be a Mannatech product user forever!"

Loyalty and comments like these are what makes Mannatech products so unique. Thousands discover the new definition of optimal health every year.

We hope you'll always be among them! ■

The Language of

Cell-to-cell communication sugar code

How do our cells communicate with each other? Well, the easiest-to-understand answer is that the process can be compared to the few simple shapes we use to form letters in the alphabet. These letters can then be used in an almost infinite variety of combinations to form words, which then form sentences.

In the same way, simple sugars can also be thought of as shapes that construct the letters, words and sentences that are the "language" of our cells, the smallest components of our body. Each word (or glycoform) conveys a unique cellular message. And virtually every cell in our body is coated with these glycoform messages.

When cells communicate at maximum effectiveness, they function at optimal levels, sustaining a healthy body.

Decoding the Miraculous Code of Life

Science and medicine have long tried to break the biocode by which the cells of the body communicate with one another, allowing highly complex functions to occur. This mysterious code is truly the language of life.

The four major classes of biomolecules are proteins, nucleic acids, lipids (fats) and carbohydrates. For many years, scientists focused on proteins as the primary communication molecules. Early in this century, however, a theoretical mathematician calculated the number of molecular configurations possible with protein molecules, plus the number of known chemical command signals needed to run the body. She concluded that there were not enough protein configurations possible to supply all the messages. A different code had to be identified.

In the 1960s, research first began to appear on glycoproteins—the protein molecules bound with carbohydrate molecules. (*Glyco* is the Greek word for sweet and refers to sugars or carbohydrates. These terms are interchangeable.) Glycoprotein molecules coat the surface of every cell with a nucleus in the human body. Glycolipids—carbohydrate molecules bound with lipid (fat) molecules—are another kind of glycoform, or glycoconjugate, found on cell surfaces.

We now know that nature uses the carbohydrates on cell surface glycoconjugates as communication (or recognition) molecules. Carbohydrates are much more structurally complex than the simpler proteins, and we have learned that carbohydrate molecules provide the most specific form of biological information for the code of life.

Much Remains to be Learned

By 1996, scientists had identified eight sugars found on human cell surface glycoforms that are involved in cellular recognition processes. Of the 200 such sugars occurring naturally in plants, to date only these eight have been identified as components of cellular glycoproteins.

Glyconutritionals are dietary supplements designed to provide substrates for the body to use in building the glyco portion of glycoconjugates on cell surfaces. Glyconutritionals are designed to make the necessary sugars available to the cells quicker and in greater quantity.

Of the four major classes of biomolecules—proteins, nucleic acids, lipids (fats) and carbohydrates— carbohydrates are the most complex. Because of their complexity, technology has only recently developed methods to study them, unlock their codes and reveal their biological secrets.

As expected with any complicated field of study, the more we learn, the more questions arise. What are the precise connections between specific diseases and changes in the sugar portions of cell-surface glycoforms? How exactly does the body metabolize each of the necessary sugars when consumed in the diet? Such questions may take many years to resolve.

We still have much still to learn. We have only just begun to understand the biochemical story written in the sweet language of life.

But what an exciting language it is to learn! ■

Glyconutrients Give a Big Boost to Vital Antioxidant

Counter the Effects of Oxidative Stress

Science has proven that we need antioxidant support to counter the effects of free radicals/oxidative stress.

The key antioxidant is called glutathione, which is produced right in our bodies. It is not only the body's most important antioxidant, but it is also the body's most important cleansing agent since it helps clean our blood.

Glutathione protects us against many types of pollution. It also protects our DNA and RNA from free radical damage. In addition, glutathione protects against cellular damage that can be caused by pesticides, plastics, benzene, carbon tetrachloride, heavy metals, cigarette smoke, smog, drugs, solvents, dyes, phenols and nitrates.

Yet, as much as we must have glutathione, we cannot get it in sufficient quantity from food alone. And, according to research done at the University of California, we are told that glutathione in tablet form—or otherwise taken orally—cannot provide glutathione's primary antioxidant protection that we all need.

So if we must have glutathione to complete the wellness picture, how can we get it? The answer—Ambrotose® complex. This glyconutritional product has been scientifically shown to raise glutathione levels in healthy tissue. In addition, it raises glutathione level by 50% when tissues have been subjected to direct toxic chemical assault.

Toxic chemical assaults represent the primary threat to our health since these assaults produce oxidative stress. This fact was demonstrated in a study done by three different laboratories simultaneously, each being blind to what the other two labs were doing. The final result clearly showed that Ambrotose® complex raises glutathione—not just for healthy tissue, but also in direct response to toxic chemical assault. ■

Q&A

"Why Do I Need Glyconutritionals?"

Q: *"Is sugar supplementation really necessary? How do you know that my body 'needs' these sugars?"*

A: The health benefits associated with adequate saccharide consumption and the difficulty in obtaining enough saccharides in our diet mean that supplementation is necessary for most people. Scientific understanding of the body's utilization of saccharides is still far from complete. However, knowledge about saccharides is rapidly increasing, as evidenced by the recent explosion of interest in glycobiology. Meanwhile, there is more than ample evidence that saccharides are important not only as an energy source, but also for the structural and functional roles they play in the human body.

Q: *"I try to eat as healthy as possible. Aren't I already getting all these sugars in my diet?"*

A: No, since there are significant losses of many nutrients in foods during all stages of food production. While fresh foods are generally regarded as being the most nutrient-rich, an extensive review of nutrition literature indicates that this is not the case at all. Two studies have reported that, compared with data collected as little as 30 years ago, some fresh fruits and vegetables contain lower levels of some vitamins and minerals. Given the documented importance of vitamins, minerals and other phytonutrients in supporting good health, we conclude that fresh fruits and vegetables should be the cornerstone of a healthful diet.

Although there is no question that we should "always eat our vegetables," due to the nutrient losses in many of our foods (including fruits and vegetables), modern diets may be deficient. Considering the difficulties of accessing fresh, nutrient-rich, unprocessed foods on a daily basis, nutritional supplementation has become appropriate for most people.

Q: *"Since sugars are broken down by HCL in the stomach, glyconutritional products aren't really metabolized, are they?"*

A: Yes, they are metabolized. Glycoforms function as a cell-surface alphabet to help the body communicate its numerous functions for optimal health. Ambrotose® complex contains ten sugars from natural polysaccharides to produce complete glycoforms.* In addition to these ten sugars, the polysaccharides have four other plant-source sugars that are precursors for the N-acetyl sugars.

Mannatech developed a formulation that provided the precursors for the N-acetyl sugars and not the N-acetyl sugars themselves for a very specific reason: N-acetyl sugars must be produced either synthetically or obtained from an animal source. Neither of these options was applicable since N-acetyl sugars will deacetylate when they come in contact with stomach acid. Therefore, they cannot survive in the N-acetyl form.

Precursors enable acetylization of saccharides. The sugars in Ambrotose® complex can be converted to the acetyl forms once they have entered a cell. This is the best way to ensure the body will get N-acetyl sugar support.

Q: *"I am allergic to aloe vera. Can I use products that contain Ambrotose® complex?"*

A: Since most people who are allergic to aloe are allergic to the ingredients in the yellow sap of the plant, our products contain none of this sap. Ambrotose® complex has freeze-dried aloe vera gel extract. Our manufacturing process extracts and stabilizes the polysaccharide molecule found within fresh—then freeze-dried—aloe, and many people who are allergic to aloe are able to ingest our product without any adverse reactions.

Q: *"A recent news article published in New Zealand asserted that Ambrotose® complex is 'just a sugar pill.' Is there any factual basis for this claim?"*

A: No. Calling Ambrotose® complex a sugar pill is like calling a diamond a chunk of carbon. "Sugar pill" is an antiquated term traditionally used to describe a placebo used in clinical trials. More than 200 biologically active sugars occur in nature. According to the well-respected medical textbook, **Harper's Biochemistry,** eight of these sugars have been deemed necessary for the proper function of the body's cells. Those eight sugars are key ingredients in Ambrotose® complex.

Q: *"There are various aloe drinks and other products available that tout the same benefits as Ambrotose® complex. Why is Mannatech's product superior?"*

A: Ambrotose® complex contains Manapol® as its key ingredient. Manapol® is the freeze-dried interior leaf gel of the *Aloe barbadensis Miller* aloe plant that was discovered and patented by Mannatech's Chief Science Officer, Dr. Bill McAnalley. Other plant saccharides are combined with Manapol® to provide immune system support—a result that has been scientifically documented.*

Manapol® provides a large percentage of the mannose component of Ambrotose® complex. The Manapol® content of each product has remained constant since the introduction of our products to the market. This content has never been lowered.

While there are many imitations on the market, there is only one Ambrotose® complex, and only Mannatech offers it. As additional patents are issued for this unique product, even more imitators are likely to appear—and then disappear. However, as greater numbers of consumers learn about it, Mannatech's Ambrotose® complex will not only remain but also continue to bring significant health support benefits to people worldwide. ■

If you would like to review other frequently asked questions about Mannatech and its products, please check Mannatech's Web site at **www.mannatech.com** *in the* **FAQs—Products** *section.*

Manapol is a registered trademark of Carrington Laboratories, Inc.

***This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.**

Mannatech's Commitment to You

Assuring the Quality of Products from Nature

Mannatech has always been committed to quality in the manufacture and distribution of products, and that commitment remains strong. Mannatech uses only high-quality ingredients in manufacturing its products, and all products are made to strict standards of production. An experienced team of quality assurance professionals, research scientists and medical doctors ensures that our products are of consistent quality by testing them during manufacturing and prior to distribution.

As Mannatech has grown, the challenge for suppliers has been not only to boost production schedules to meet increased demand, but also to ensure that these products retain the consistency and quality the company demands. Only manufacturers that meet the stringent requirements of the FDA's proposed regulations for dietary supplements and that have been inspected by the FDA or certified by professional associations such as the Nutritional Foods Association (NNFA) or the NSF International can manufacture Mannatech products. Members of the management team meet with suppliers and manufacturers on a regular basis to ensure their processes meet Mannatech's rigorous standards for quality.

Products are manufactured using pre-established, Mannatech-approved quality standards to ensure batch-to-batch consistency of every product. Mannatech's comprehensive quality system is based on the FDA's proposed Good Manufacturing Practices for dietary supplements and enhanced to incorporate the unique requirements of international markets. In fact, many of the professionals on staff are from the pharmaceutical industry. Mannatech sets the standards of excellence as high as possible for every product.

Mannatech specifications, sampling plans and test procedures assure that all of the products conform to the appropriate quality standards. Before a product or ingredient can be released for use, it must meet standards based on rigorous specifications for microbiological, chemical and physical analysis.

Finished products and ingredients are tested to determine their stability under controlled storage conditions. The test results are used to establish suitable expiration dates.

Mannatech identifies any materials, components or final products that are not up to the company's exacting standards and thoroughly investigates the causes, documents the findings and controls disposition to ensure that only products meeting proper characteristics are distributed.

Mannatech does not use synthetic carbohydrates in any of our products. All Mannatech products contain naturally occurring, plant-derived ingredients and are designed to help maintain optimal health with nutrients working through normal physiology to support the body's immune and endocrine systems.* ■

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Ambrotose® Complex—One of a Kind

Countries Grant Company's 13th and 14th patents

You won't find anything like Mannatech's Ambrotose® complex available from any other company since there is nothing else like Ambrotose® complex. That's because patents issued around the world protect the company's proprietary formulation of eight essential saccharides. These patents are official government recognition that Mannatech's innovative research and unique glyconutritional formulation are truly unique and unlike anything anyone else is now producing—or will ever be able to produce.

Generally speaking, a patent is the grant of a property right to the inventor. The term of a new patent varies from nation to nation—in both the United States and Canada, it is 20 years from the date on which the application for the patent was filed with the government's patent office. Patent grants are effective only within the nation granting the patent, so frequently patent applications for a single invention are filed in numerous nations around the world.

There are a number of advantages to inventors and companies of having patents on their intellectual properties. Perhaps most significant is product uniqueness in the market that can result in greater long-term return to shareholders, plus job security for employees. However, consumers also gain several noteworthy advantages when they select patented products:

- Consumers can be reasonably confident that they are dealing with a reputable, solid company.
- Patented products have higher quality standards and greater product consistency than non-patented products.
- The likelihood of continued manufacture and availability of a product increases significantly when a company has invested the considerable time, effort and funds required to obtain a patent.

A Product for Everyone Everywhere

While Mexico and Hong Kong are the latest countries to issue patents to Mannatech for dietary supplements containing glyconutritionals, the list has grown steadily since the first patent was issued in South Africa in 1998.

Mannatech Chairman Sam Caster said, "It's always exciting to add to the list of countries where our technology is patent-protected. As our consumers have long known, we have very special products. They're proprietary and supported by science. As a company, we are in the perfect space right now."

"Having patents on our products provides Mannatech with certain compositions, claims and methods of administration that other companies—including drug companies—cannot use or make," added Dr. Bill McAnalley, Mannatech Senior Vice President and Chief Science Officer. Dr. McAnalley is the lead inventor on these patents and also has his name on more than 150 other patents worldwide.

Perhaps the most concise way to emphasize the importance of patents is to say that, wherever you may be in the world, unless a product is clearly marked as being from Mannatech, you'll know it's not Ambrotose® complex! ■

Nations Granting Patents for Glyconutritionals to Mannatech
(through June 1, 2003)

France
Germany
Ireland
Italy
Liechtenstein
Spain
Switzerland
The United Kingdom
New Zealand
Australia
Singapore
Mexico
Republic of South Africa
Hong Kong

MANNATECH

For more information, contact:

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