Expand Your Mind
Improve Your Brain

Three Volumes in One

J.C. Spencer
A very big THANK YOU to the special people who helped make this book possible. At the end of the book I have referenced individuals including my teachers. These scientists, researchers, writers, and individuals contributed greatly to this book. Thank you for the work you have done to benefit others! Without the faithful staff at The Endowment for Medical Research, none of this would have manifest.

Legend for Glossary and References

✈️ = speaker we have engaged at an event of The Endowment for Medical Research.

✈️✈️ = Speaker, available for speaking engagements. On the Speaker’s Bureau of The Endowment for Medical Research.

🔗 = Served on the staff or volunteered time for The Endowment for Medical Research.

📝 = Those who helped edit and/or make suggestions to Expand Your Mind - Improve Your Brain.

📝📝 = Authored or co-authored a published paper(s), article(s), or comments referenced in the book.
PURPOSE for the Book

My purpose for writing this book is to help you stay mentally active and keep the neurons firing and help you to not worry so much because there is hope. I will encourage you to eat more super foods – more brain foods. I will encourage you to eat and drink high pH foods and drinks, to drink lots of clean water, preferably oxygenated and higher pH water (less acidic as explained in Chapter 20).

The purpose is to help you encourage others to also exercise more and breath deeply to get more oxygen to your brain and the rest of your body. Take a big breath! There now, you just got more oxygen into your lungs, and 25% of it is now on its way to your brain.

This book can help you fulfill your purpose in life. It can help you make new friends, or at least work on keeping the ones you have, if they are worthy of you. Do something good for someone today. Listen to good music. Read and listen to good humor every day. Read Scripture and other meaningful positive writings. Do not let negative people put negative thoughts in your head. Be happy. Be filled with joy which can be your strength. Make today better than yesterday and tomorrow better than today.
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Introduction

All my life, science has held a place close to my heart. It is not possible for me to separate science and faith. For me, they support each other. There is no conflict. In 1994 I started an exciting science venture that has become a passion. During these last few years, I have made friends with some of the most knowledgeable doctors and scientists on the planet, especially those in the field of glycomics. You will meet some of them in this book.

You will soon see why Massachusetts Institute of Technology (MIT) says that glycomics is “one of the 10 emerging technologies that will change the world.”

It has been a joy to help train professionals in the healthcare industry, and the best is yet to come. Art Linkletter was the keynote speaker at our first Glycomics Medical Conference, and Dr. Ben Carson honored us at the second conference.

It is not often that anyone has the opportunity to participate in the pioneering efforts of a new technology. “Scientists are saying that glycomics could fuel a revolution in biology to rival that of the human genome.”

- New Scientist 10/02

“Glycomics is the study of applied biology and chemistry that deals with the structure and function of carbohydrates (sugars). The term glycomics is derived from the chemical prefix for sweetness or a sugar, “glyco-,” and was formed to follow the naming convention established by genomics (which deals with genes) and proteomics (which deals with proteins).”

-Institute for Glycomics, Griffith University

“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.’ ... ‘If you ask, what is the glycome for a single cell type, it's probably many thousands of times more complex than the genome,’ says Ajit Varki, Director of the Glycobiology Research and Training
Raymond Dwek, Head of the University of Oxford’s Glycobiology Institute, who coined the term ‘glycobiology’ in 1988 says that sugars were often dismissed as unimportant, ‘as just decorations on proteins - people didn’t know how to deal with them’. They could not have been more wrong. As recent advances in genetics have unfolded, [sugars are more important than ever thought] ... Varki sees it as a journey of exploration. “It’s like we’ve just discovered the continent of North America. Now we have to send out scouting parties to find out how big it is ...”

- New Scientist, 10/02 by science writer Karen Schmidt

“But even as doctors and drug companies struggle to interpret and exploit the recent explosion of data on genes and proteins, yet another field of biology is waiting to break out: glycomics. This emerging discipline seeks to do for sugars and carbohydrates what genomics and proteomics have done for genes and proteins -- move them into the mainstream of biomedical research and drug discovery.”

- Technology Review, 10/01

 “[Glycomes are] known to regulate hormones, organize embryonic development, direct the movement of cells and proteins throughout the body, and regulate the immune system. It shows yet again that the DNA in the genome is only one aspect of the complex mechanism that keeps the body running — decoding the DNA is one step towards understanding, but by itself it doesn’t specify everything that happens within the organism.”

- Michael Quinion

Quantum physics require that science and faith work together. There is no conflict for me, they support each other. Albert Einstein said, "Science without religion is lame; Religion without science is blind." It is my love for science and my thirst to know how everything works that makes it possible for me to better understand how you can, indeed, Expand Your Mind - Improve Your Brain.
FOREWORD

The latest in scientific breakthroughs will make it possible to improve brain function physically and mentally.

Your brain operates on the fuel you supply, be it super food or junk food. The food supply line is for the physical. The mental supply line is super knowledge or junk knowledge determined by the choices you make moment by moment.

I have distilled pertinent knowledge from research by leading professors, doctors, and experts from around the world. Many universities have, within the last few years, established departments or research groups to explore and teach students in the related fields of neural science, glycobiology, glycomics, and mitochondrial research.

The National Library of Medicine cites over 434,000 (yes, that is four hundred thirty four thousand) references to published papers on glycoprotein technology. Scientists are adding so many new research papers each day (thousands per month) that no one can keep up with the progress of this science.

The U. S. Patent Office has issued an astounding number of patents on the use of these nine sugars. When you take the number of patents on each sugar and add them together you get (as of this writing), 153,613 patents. About 103,000 of these patents were issues since 1995.

Tomorrow’s world will hardly be recognized by today’s seasoned scientists and teachers. Change can be a positive experience. You can, indeed, Expand Your Mind - Improve Your Brain.

This book will help prepare you for today’s and tomorrow’s world and show you how to better mine the data in order to utilize the largest knowledge database in human history. Knowing what to do with all this knowledge is called wisdom.

Expand Your Mind - Improve Your Brain is the beginning of an investigation of the brain and the mind that will expand the way you think and the way you live. This book will open up a whole new world of possibilities for you.
About the Author

J. C. Spencer is founder and CEO of The Endowment for Medical Research. He is a businessman, husband, father and grandfather living in Houston, Texas. He grew up being trained in business and manufacturing in the family-operated food packing company and milling company in Southwestern Missouri. Science was his love, and the refinement and perfection of any manufacturing and engineering process was his joy. His passion for science and a talent for graphics and photography led him to create a representative position with one of the largest color printing companies in the U.S. It was here that he learned the synergy of finding a need and filling it. He has worked as a consultant for many engineering and manufacturing corporations which gave him a unique and broad perspective in operations management. Over the years, Mr. Spencer expanded his ventures into various areas of science and finance. He has studied the science of the brain much of his life, and this book is the culmination of years of study and research. He has lectured internationally and currently speaks about glycomics. He has lectured on the science at Vanderbuilt University and covers many aspects of health improvement for groups across the country. His passion to research and develop ways and means for improving brain function in children and adults benefits all of us. In just the few hours that it will take you to read this book, you can take advantage of his years of intense research that is handed to you on a silver platter in the “multi-book”* Expand Your Mind - Improve Your Brain.

The Endowment for Medical Research, a 501(c)(3) non-profit faith-based medical research and education public charity and think tank based in Houston, Texas, conducts nutritional surveys throughout the United States, Canada, and some foreign countries. The Endowment is also a think tank with a modest annual budget of approximately one million dollars and has supplied approximately three million dollars worth of nutrients to participants in nutritional pilot surveys for various neurodegenerative challenges including Alzheimer’s, Parkinson’s, Huntington, ALS, Lyme, Autism, and ADHD, as well as a number of case studies. Two papers have been published on the advancements made with Alzheimer’s patients. The Endowment sponsored the First Glycomics Medical Conference in 2005 and the Second Glycomics Medical Conference in 2006. Category 1 credits toward AMA Physician’s Recognitions Award are available. Continuing Medical Education Credits and Continuing Education Units are furnished to pharmacists, physicians, nurses, chiropractors, dentists, and dietitians via enduring media.

Education can save a child and a nation.

J. C. Spencer

“My people are destroyed for lack of knowledge: ”
Hosea 4:6a KJV
You CAN expand your mind.  
You CAN improve your brain.

You are about to explore your own brain and venture to the edge of this new frontier of accelerated knowledge. In Chapter 1 you will learn some practical ways for improving your own brain function.
The mission statement that guides everything we do at The Endowment for Medical Research is: *Improving brain function in children and adults without drugs or harmful side effects.* That is not just a statement. We are beginning to achieve that objective.

**Expand Your Mind - Improve Your Brain** will be of special interest to the person that enjoys thinking and wishes his or her brain could think better. This series will also be of interest to those who have a family member with mental or motor challenges. There is mounting evidence that you can improve brain function in young children and even in aging Alzheimer’s patients.

In some of the chapters I will discuss how nutrition plays a contributing role in brain function or brain malfunction. Together, we will also explore ongoing research and pending research on brain function and how you may personally participate in some cutting-edge science integrated into our Nutritional Pilot Surveys. The addendum to our Mission Statement could be: “*Whatever works!*” Of course, we will still hold to our commitment of using no drugs or dangerous plants in the Clinical Studies or Nutritional Pilot Surveys.

Improved brain function is the key to better use of knowledge. The key to improved brain function is improved perception. The key to improved perception is the ability to create redundant memory storage for quick retrieval.
You can plan more strategically with quicker response time in thought and physical activity. As the brain functions more efficiently, the motor functions in every part of the body may operate at a higher efficiency.

I will review how laboratory mice are made smarter and how those studies may apply to children and adult humans. I will discuss a number of integrative means for improving brain function and how the different approaches may have synergistic possibilities.

A number of scientists will be referenced and quoted. Some have also co-authored some of the chapters. I have commitments from MDs, PhDs, and authoritative neurology experts to assist in an ongoing series of newsletters. These newsletter will be available to those who wish to keep up with this expanding science.

To set the stage for this brain and mental study, here is a quick review of the Nutritional Pilot Surveys we conducted with Alzheimer's patients. Two papers were published in PROCEEDINGS of the Fisher Institute for Medical Research and are available from them or from The Endowment for Medical Research in their entirety.

Our first published Alzheimer's paper was titled: A Prospective Open-label Pilot Survey in Patients with Alzheimer's and Vascular Dementia Provided Micronutrients Containing Dietary Supplements. It was published in March, 2006. This study population consisted of 36 individuals (21 females and 15 males).
The average age was 75.8 years (73.3 for females and 76.3 for the males). Participants were from 22 states. The reported clinical improvements were statistically significant. The responses observed support a positive impression sufficient to justify a larger and more formal clinical study.

A follow-up paper was published in March, 2007, entitled: *Alzheimer’s Disease: Expanded Study with Micronutrient Supplementation*. This study population consisted of 48 individuals (22 females, 26 males). The average age was 77.5 years. Participants were from 27 states. The results are available in the published paper.

Because of these two nutritional pilot surveys, a grant was given for a university study. Additional funding could make medical history. We are seeking additional grants to cooperate with major universities in clinical studies using breakthrough technology in improving brain function.

I will outline some of the possible integrative means of improving brain function. I encourage you to subscribe to my newsletter which will bring you a review of the latest in advancements in the field.

There are other serious ways to improve body chemistry beyond good nutrition. I will look at the possibility of proliferating neurons, stem cells, and possibly improving the hippocampus area of the brain. I will review ways to better exercise the brain and discuss what actually happens when you play these fun mind games.

Because of these two Alzheimer’s Nutritional Pilot Surveys, a grant was given for a university study.

The public is looking for evidence based healthcare.
In the body chemistry facet of the protocol, I will explain why good **nutrition** is key to improving your **blood** chemistry. You can take the first step toward better **nutrition** by cutting out refined cane **sugar** and replacing it with the healthy **sugar trehalose**. You will learn about bad **sugar**, good **sugar**, and super **sugars**. I will explore the role of other **sugars**. You will see how better **oxygenation** of your **cells** is an important factor in improving your brain **function**. I will explore different ways to make that happen.

Tell your friends that they also have the opportunity to subscribe to my free newsletter. I believe this will be mind expanding in a fun way that will contribute to a better life for all who participate. Here is the link for the newsletter.

www.EndowmentMed.org
The Mission Statement at The Endowment for Medical Research is:

*Improving brain function in children and adults without drugs or harmful side effects.*
Your brain can better recall details from the past when...

It has been verified through various studies that, with certain micro-nutrients, brain function in mice and brain function in Alzheimer’s patients have been improved in some subjects. While we have what we call hyper-responders,
we also have slow responders, and some non-responders. Our challenge is to discover why some respond so well while others do not seem to respond at all though some of their other health challenges may be improved.

Every individual brings into the studies their unique personal DNA. Certain DNA markers may pre-dispose positive results. Different medications can also interfere with the studies and must be taken into consideration.

Multiple studies conducted over a number of years show that babies who receive mother’s breast milk have improved brain function and make better grades in school, including college. Ardythe Luxion Morrow, PhD, M.Sc is one of the world’s foremost authorities on the subject of human mother’s milk. She presented her work at the Glycomics Medical Conference in Houston sponsored by The Endowment for Medical Research. Dr. Morrow co-edited the book, *Protecting Infants through Human Milk: Advancing the Scientific Evidence* (Kluwer, 2004). *

World-class experts in glycomics presented their work at both the 2005 and the 2006 Glycomics Conferences, The focus has been, and will continue to be, on improving communication of the cells in the body. This directly affects your general health including brain function.

More functional neurons with more functional synapses improve brain function. Increasing functional neurons and synapses is THE KEY to everything I am talking about in *Expand Your Mind - Improve Your Brain*.
Certain **micro-nutrients stimulate** the proliferation of **functional neurons**. H. Reg McDaniel, MD has produced his findings on **fetal alcohol syndrome (FAS)** children. The children in the study were diagnosed with FAS, and the families were told that their **children** would never be able to **function** normally. Dr. McDaniel found that the children, after eight years, while not completely “normal,” are enjoying life, riding bikes, playing on the trampoline, and going to school. The apparent brain **function** improvement was due to the **micro-nutrients** the children received which were similar to those found in **human mother’s breast milk**. **

**FACT:**  
**Laboratory mice have been made smarter.**

**FACT:**  
**Children have been made smarter.**

Laboratory **mice** have been made smarter, and these studies may apply to children and adult humans. In the July, 2007, issue of *Scientific American*, Joe Z. Tsien reported on his team’s research at the Center for **Systems Neurobiology** at Boston University. He made headlines in 1999 when he was at Princeton University where he generated a smart mouse strain capable of learning faster and remembering things longer than **standard laboratory mice**.

Use your own brain to do a little mind game with me **right now**. It will demonstrate how you can reach back in time and recall detail events of a certain moment. Remember the details where you were and what you were doing the moment you heard the shocking news of 911?

Did the details of that moment come into clear focus? Now, reach back a little further. Do you remember the details of the moment of the Challenger space craft explosion?
Your brain can better recall details from the past when...

Chapter 2

Now, if you are old enough to remember, where were you and what were you doing when John Kennedy was assassinated?

You have probably just relived three events of the past and re-recorded those thoughts chronologically twice (the past event again and one in the present) while simultaneously making impressions a number of other retrievable ways.

Professor Joe Z. Tsien was able to stimulate and record improved brain activity in the hippocampus area of the mouse brain with different dramatic events. Event stimulation can be positive or it can be negative. I will discuss the difference in another chapter. We are on an exciting venture, and in my next chapter I will discuss more ways that you can improve your brain function.

If you are not using the sugar trehalose instead of regular table sugar, please consider it. Also, we would greatly appreciate it if you would give us feedback about any improvement in brain function you observe as a result of using the sugar trehalose instead of regular table sugar – either in yourself or anyone in your family.

www.endowmentmed.org

* Dr. Ardythe Morrow’s presentation at the Glycomics Conference is part of a 14 hour Continuing Medical Education Credit course available on DVD, available for CME or CEU credits for $299 with a 580-page syllabus on CD or to the general public for $199 without the syllabus. Order online at www.EndowmentMed.org.

** The CD and DVD are available for a contribution of $50 that goes to the Fisher Institute for Medical Research and The Endowment for Medical Research. www.EndowmentMed.org.
"Towering genius disdains a beaten path. It seeks regions hitherto unexplored."

Abraham Lincoln
Your brain can better recall details from the past when...
Dramatic events trigger firing of more neurons

Your neurons are who you are, your memory, your emotions, and your personality. Hundreds of billions of neurons reside in your brain. All these neurons are interconnected at their synapses. Synapses are cellular contacts that transmit the electrochemical messages that give your mind and body the ability to operate. Your brain regulates all your body's organ systems.
I have reviewed the work of many researchers and compiled this information into an integrative system for improving brain function. I will make mention of the different reasons for poor memory and present a variety of possible means for improving cognitive activity.

Physical energy drain can account for a lower quality of brain function. Poor health not only affects all of the body, but it especially affects the brain. And, poor health is caused by a lot more than just not eating all the right foods, albeit quality nutrition plays a major role.

Toxins in the air and water, as well as in the food, contribute to lower brain function. This fact is graphically testified by mutations of animals. What is happening to the DNA in animals because of toxins is astounding. Hormones fed to animals and used in growing food for humans are also appearing in your drinking water. And, that is not our only problem.

The research of David L. Busbee, PhD, on the faculty of Genetics and Toxicology at Texas A&M University, showed that bottled water may compound the problem because of plasticizers leached from the water bottle itself. Dr. Busbee detected plasticizers in Texas water, including nonylphenol, diethyl hexyl phthalate, diethyl phthalate, butyl benzyl phthalate, and dibutyl phthalate. These toxins alter gene expression.

Dr. Busbee was a presenter at the Glycomics Medical Conference where he presented his work in Glycomics and Cancer and Altering Gene Expression. *
The immune system is incapable of handling these compounding toxins. Some scientists project that the immune system of the average person in the United States is reportedly weakening at the rate of 2% to 3% PER YEAR. At that rate, how many years will it take before the average person has the immune system of today’s AIDS patient? That is a scary thought.

Tumors and cancers throughout the body ARE caused by free radicals that need to be removed from the body. Antioxidant supplementation has become a necessity for a healthy body.

Preventing free radical activity that can weaken the brain is an important step toward securing better brain function. Improving the immune system has become vital for a better quality life.

Proliferation of more functional neurons improve brain function. Studies show that glyconutrients aid the brain and give an individual an improved quality of life. You can help improve the quality of life for those you love. I am confident that my wife’s mother would not be with us these last number of years had she not been on a regimen of glyconutrients.
We all want to be alert, knowledgeable, and have a level of perception that allows us to maximize the use of our knowledge. We want to have long-term and short-term memory and have the ability to plan and carry on quality physical activity for as long as possible. This can only happen when brain functions are operating efficiently.

Motor skills depend on brain function.

You have learned that dramatic events can cause us to remember details around that event.

Dramatic events may have either a positive or a negative effect. A negative effect may occur when the dramatic event harms the body in some way. Shortly after my sister slipped and fell on the ice, she developed fibromyalgia.
I have heard of many health challenges that seem to have been triggered by a dramatic event. The body’s whole neurological system may come into play during a dramatic event. I believe a dramatic event causes the nervous system to cry out – either for help or with glee.

Research indicates that the severity of the trauma and the resources available within the body at that moment determine the results. The brain goes into high gear to address the situation in its attempt to resolve the problem. A good immune system and active neurons come to the aid of the body.

Dramatic events, especially pleasant ones or self-induced events, can be very positive and actually improve brain function. Are you willing to participate in a dramatic or pleasant event to improve your brain function?

I will discuss in another chapter how music may help you learn better, retain knowledge better, and retrieve knowledge better many years later.

In Chapter 7, I will discuss laying down layers of memory in hierarchical, well-organized fashion.

Now, let’s look at how neuroscientist, Joe Z. Tsien, simulated dramatic events to improve brain activity in the hippocampus area of the mouse brain. Tsien developed a device to monitor neuron activity of
a mouse brain in the CA1 region of the hippocampus area. This is significant because the hippocampus is the first area of the brain where Alzheimer's may be detected. Nutritional pilot surveys conducted through the Endowment for Medical Research have demonstrated some hippocampus improvement. More research is needed, and I believe this research will make medical history.

Professor Tsien then used his monitoring device to record the firing of neurons during a dramatic event, such as a sudden puff of air on the back of the mouse, the mouse in an elevator fall (a jar that was dropped and caught), and the mouse in an earthquake (shaking in a cage). All three dramatic events caused a positive response of the firing of additional neurons. I will discuss how this can apply to you in my next chapter.

* Dr. Busbee's presentation is part of a 14 hr CME/CEU Credit course available on DVD for $299 with a colorful graphic 580-page syllabus on CD, or for the general public at $199 without the syllabus. www.EndowmentMed.org.
Brain overload, sometimes expressed as Attention Deficit Trait (ADT), is the state that results when a normal brain is under too much stress, such that the person suffering from ADT makes poor decisions, ignores information and otherwise limits their alternatives and options. The need is not a psychologist but a new perspective.
You have learned that a dramatic event triggers the firing of more neurons in your brain. How are thoughts of dramatic events embedded differently in the mind than events that are not perceived as dramatic?

Brain neurons act in concert to form a memory that is out of the ordinary. The very fact that an event is out of the ordinary seems to activate firing of more synapses. Can we discover positive ways for firing more neurons to increase brain power? Scientists believe that as more synapses are fired in your brain, memory may be improved. That may not always be the case, and I will discuss why later. Scientists are working on the neural code but, do not yet have an understanding of it.

Advancing the study of the neural code is cutting-edge science and may affect how we live tomorrow. The neural code defines the set of rules your brain follows to collect, store, and recall tiny electrical signals and convert them into knowledge, perception, and memory. This same set of rules are used to build your behavior.

Could your life get better if you found ways to improve these tiny electrical signals? Hold that thought. I will soon discuss how lives will change when we are smarter.
My first computer didn’t even have a hard drive. My first real computer had 10Mb, and the salesman told me that I would never fill it. Dual processors were developed years later. A dual processor splits up the data and processes half of it on one processor and the other half on another processor and then puts the data back together as if it were processed on one processor, but it does it in half the time.

When your brain is in information OVERLOAD, multiple processors (neurons) are instantly brought online to evaluate the data. The type of event determines the number and the types of neurons activated. Schools of neurons are held in reserve for the moment more brain power is required.

Your brain can store more data than the largest computer. In the same way that a computer’s capabilities are not determined by its size, so it is with the human brain. What is important is capacity and the ability to use that capacity. It may be that more data can be stored in each strand of DNA inside each cell of your body than ever imagined. I will talk about that later.

In the mid 1990s, it cost $1,000,000 to store a terabyte (Tb) of information in a computer. Today that same amount of data can be stored for less than $300 on disk and only $60 on tape. Solid state capabilities may soon bring that cost even lower.

Storage capacities are now being measured in petabytes (PB). A petabyte is 2 to the 50th power (1,125,899,906,842,624) bytes. A petabyte is equal to 1,024
Oh, to be able to have the kind of advancements in healthcare savings that we have had in computers and data storage savings. I submit to you, that IT IS POSSIBLE. Part of that concept was presented at the Glycomics Medical Conference by Lory Moore, JD.* I will discuss later in the book a way to cut healthcare costs in America by over One Trillion Dollars ($1,000,000,000,000) annually. You draw your own conclusion and let me know if you think the plan will work.

Poor memory and poor cognitive activity are devastating, not only for the individual with poor cognitive activity, but for everyone who loves them. I am seeking more practical ways to safely improve brain function because I have seen families experience untold delight as the clock seems to turn back for loved ones with Alzheimer’s, Parkinson’s, and Huntington’s disease. There is another major benefit. The economic impact on healthcare costs could be savings in the hundreds of millions of dollars.

My objective and calling is to help discover ways to safely improve brain signals. It may be by learning how to best activate more neurons and cause a proliferation of more functional neurons.
A friend, whose husband has Alzheimer’s, told me that after giving him a particular nutritional supplement, she had noticed more positive cogitative activity WITHIN MINUTES. I told her that was impossible because the capsule could not dissolve that quickly. She responded that she had taken it out of the capsule and put the nutrient in his applesauce.

She had noticed her husband displayed more positive cogitative activity WITHIN MINUTES.

Wow! This anecdotal information was significant. Brain activity had been triggered quickly. I knew we were onto something very exciting, but how could we prove it? By applying reverse engineering, we were able to determine what was actually happening. The supplement that the spouse of the Alzheimer’s patient had given him was a special blend of a standardized diascoria precursor complex to dehydroepiandrosterone. The amount of dehydroepiandrosterone in your brain is normally six and one half times as much as the amount that is in your bloodstream, but it is missing in Alzheimer’s patients.

My objective is to discover every possible way for improving brain function, with the foremost thought of, “DO NO HARM”, and then design an integrated system that will work better than any single component. As you read this, you may be surprised at what you discover about how to make the brain work more effectively.

My objective is to discover every possible way for improving brain function, with the foremost thought of, “DO NO HARM”

Special events, particularly pleasant events or events you choose to participate in, hold a hierarchical organizational place in the brain. The time period around that event will remain clear in your memory years later. Your perception of an event determines if it is positive or negative. Your attitude affects your whole nervous system and
determines if event data is stored for your good or your harm. Your neurons are trained to be receptive to your will. Now, that's a quantum thought. How did you respond to it?

* The Glycomics DVD Series including the presentation by Lory Moore, JD is available as part of a 14 hour CME/CEU accredited training at www.EndowmentMed.org.

Your attitude affects your whole nervous system.
Learn how to improve your brain function by understanding what may be holding you back

Neurons are declared to be the most highly advanced and functional cell in the body. You learn, remember, make decisions, interpret, and control muscles with neurons.
A question asked in Chapter 4 was, “Can we discover positive ways for firing more neurons to increase brain power?” The answer is, “Yes.” We know that the more neurons available, the better opportunity you have for increasing brain function.

Neurons are at the very core of all brain function and at the heart of every neurodegenerative disease. Recent revolutionary information indicates that we now know we have the potential to foster repair and regeneration of the human brain.

Later I will talk about increasing the number of neurons, but for now, let us look at what may inhibit the neurons already in place from firing as they should.

Myelin sheath damage contributes to many health challenges. The myelin sheath is an insulating layer that forms around nerves. It is made up of protein and fatty substances. This film consists of fat-containing cells that insulate the axon from the electrical transmission of signals. A gap exists between each myelin sheath cell along the axon. Since fat inhibits the flow of electricity, the signals jump from one gap to the next.
The myelin sheath (a tubular case or envelope) gives the whitish appearance to the white matter of the brain. Myelin cells are included in the category of Glial cells. Glial cell function to support the processes of neurons in a variety of ways. The glial cells forming myelin sheaths are called oligodendrocytes in the central nervous system and Schwann cells in the peripheral nervous system. The gaps (approximately 1 micrometer wide) formed between myelin sheath cells along the axons are called Nodes or Ranvier.

Since fat serves as an insulator, the myelin sheaths speed the rate of transmission of electrical impulses along the axon. The electrical impulse jumps from one node to the next at a rate of up to 120 meters per second. This rapid rate of conduction is called saltatory conduction.

For the brain to work, it must be connected and the myelin sheath must be intact. The proliferation of new neurons and the repair of the myelin sheath may both be possible. Glycomics will play a major role in this nanotechnology.

The science of how your cells communicate is relatively new. The science of glycobiology is relatively new with Oxford University beginning to look into the function of oligosaccharides in the 1980s. In 1985 the research group at Oxford published a paper in Nature about glycosylation. Oxford University Press in 1988 started the journal Glycobiology. Raymond Dwek, Head of the University of Oxford’s Glycobiology Institute, coined the term “glycobiology” in 1988, and it was soon used in science around the world.
The following is a quote from the Institute for Glycomics at Griffith University: “Glycomics is the study of applied biology and chemistry that deals with the structure and function of carbohydrates (sugars). The term glycomics is derived from the chemical prefix for sweetness or a sugar, ‘glyco’, and was formed to follow the naming convention established by genomics (which deal with genes) and proteomics (which deals with proteins).”

In my next chapter, I will discuss additional ways to improve brain function and how that can improve your quality of life in multiple ways.
My father taught me to take care of the little things in life because the big things, he said, would take care of themselves. I never knew how true that was until I learned about cells and systems.
Neurons are at the very core of all brain function and at the heart of every neurodegenerative disease.
You can train your neurons to be more effective

My passion is to help discover ways to safely improve brain signals through the better care and feeding of neurons. Some scientists may think that is funny. My response to the skeptic, who is rolling on the floor in laughter at me, is to point out that humor can be a very positive way of caring for the brain and your whole nervous system. I am glad I can contribute. Now, get up off the floor and listen to what I am saying. It could make you smarter.
In this chapter I will discuss how to convert a passive neuron into a positive, responsive neuron. You have learned that a dramatic event makes an indelible mark in your memory. You can quickly recall details surrounding dramatic events.

When a dramatic event is positive, it gives you a wonderful warm feeling of peace over and over for as many times as you recall those moments in memory. When the event is negative, it gives you a feeling that is not filled with warmth and peace, but instead is very unpleasant. You get that same bad feeling over and over for as many times as you replay the event.

As the reality of the dramatic event is processed through your neurons, it affects your emotions. A cry or laugh may be the result. Although events are not always dramatic, every one is recorded. Everything you have ever experienced through sight, sound, smell, savor, and sensuality is indelibly etched in your neurons. Retrieving these etchings is the challenge.

A neuron’s propensity depends on how you have trained it. And, YOU CAN TRAIN NEURONS. You may call this tracing, or laying down memory, layer upon layer. As you lay down hierarchical memories, you establish the rules upon which future memories will be laid down.
Positive memories are a lot more fun than negative memories, yet most people choose to dwell on the negative and consequently pre-determine a more negative feeling and result.

The same dramatic event is different for every participant. While one may be paralyzed with fear, another may become mobilized to be the hero. Events that may not be fearful to others may cause a person with a propensity for fear to have those traits of fear embedded more deeply. This compounds and reinforces what is already there because these fears hold a more hierarchical organizational place in the brain of a person with a propensity for fear. At the same time the same event can strengthen, rather than weaken, the person not gripped by fear. Both individuals may have an increased number of firing neurons, one firing for positive and one firing for negative.

In another chapter, you will learn how even the negatively-programmed mind can be taught to become more positive. You will learn how pleasant events, and even humorous events, can build more user-friendly neurons. Together we will explore various aspects of this relatively-new science of how cells communicate.

The future of healthcare is coming at us fast and for the willing, it is already here.
Science writer, Karen Schmidt, wrote about glycomics in *New Scientist*, October, 2002, “‘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.’ ... ‘If you ask, what is the glycome for a single cell type, it’s probably many thousands of times more complex than the genome,’ says Ajit Varki, Director of the Glycobiology Research and Training Center at the University of California in San Diego ... Raymond Dwek, Head of the University of Oxford’s Glycobiology Institute, who coined the term “glycobiology” in 1988, says that sugars were often dismissed as unimportant, ‘as just decorations on proteins - people didn’t know how to deal with them.” They could not have been more wrong.

As recent advances in genetics have unfolded, the importance of sugars has become ever more apparent ... Varki sees it as a journey of exploration. “It’s like we’ve just discovered the continent of North America. Now we have to send out scouting parties to find out how big it is ...”

Participate in our data gathering effort. If you are not yet using the glyconutrient sugar trehalose instead of regular table sugar, please consider it. Also, we would sincerely appreciate your feedback, should you see any health or brain function improvement through the self-funding Nutritional Survey available online at

www.endowmentmed.org
Help make this research fun.
Enjoy healthy trehalose lemonade with the whole family.

Make healthy lemonade, hot or cold. Squeeze one or two lemons (depending on size) and add enough of the sugar trehalose to almost cover the lemon juice then add hot water. Want cold lemonade? Just use cold water or add ice. Trehalose sugar dissolves more slowly in cold water, but once it is dissolved, it stays dissolved. Start the day with a cup of HOT trehalose lemonade. It’s better than a cup of coffee and healthy too!

Reward: The sugar trehalose is designed for sustained energy.

While trehalose is a healthy sugar, diabetics should continue to monitor their blood sugar regularly.
You can train your neurons to be more effective

Take the hierarchical management test after you have read Chapter 7.
Understanding the importance of hierarchical thought management

There is an old Chinese proverb about a good dog and a bad dog that fought much of the time. When asked which dog wins, the owner responded, “The one I feed the best.”
Science is in the beginning stages of discovery of the Memory Code. Investigators are getting closer to uncovering this UNIVERSAL NEURAL CODE – the rules the brain uses to identify and make sense of the five senses of sight, sound, smell, savor, and sensuality.

I believe that scientists will soon discover, and begin to explore, the Memory Code. You will learn that there are super neurons. These super neurons form a hierarchical structure that determines a person’s character. These super neurons develop over the years and are placed there by choice, be it by active or non-active will.

It will be interesting to see what scientists “discover” concerning the universal neural code. The code will help explain how memory is embedded. Although the code may be the same when it is APPROACH behavior or REPROACH behavior, there is a drastic difference in results determined by the hierarchical structure followed within the universal neural code.

When a scientist attempts to play the role of God, it will be a different set of rules than if they recognize that there is a Creator behind the wonderful design. When the authority factor is understood and followed, there is peace. When the rule of natural law is not followed, there is chaos. My previous writing on chaos theory speaks even to the many specifically-designed neurons in their unique functions.
All systems utilize a design (structure) and have a function. Chaos happens when the design and function do not fit the systems. Everything from infinity inward to infinity outward, from within an atom to beyond the universe, is one system. The universe we know is millions of light years in radius. This envelope of time and space may be the bubble in which evil and its resulting chaos are bound. Is the universe a giant cosmic prison from which there is no escape except through Truth? I will explain the disaster untruth brings in just a moment.

One system within a more powerful system must operate under the terms of the more powerful system, or chaos takes over. Each cell of all life and all matter is a system to make up many other systems. The design of each atom is from the blueprint. The function incorporates time and results in the intended system where everything is engineered according to design – the genetic code.

Each system has an established design boundary that separates it from other systems. The shield of that system may be a force field, a membrane of a cell, the hide of an animal, the wall of a city, the border of a country, the atmospheric envelope of earth, or the unseen bounds of our universe.

Design + function = system

The design can be captured as a single frame of time.
The components designed into a system that enable it to function may include the nucleus and electrons, the molecules of the cell, the organs of the animal, the inhabitants of the city, the governments of the country, or the oceans of the planets.

The design can be captured as a single frame of infinitesimal time. Function is more blurred to our perception as it considers time while the system changes, grows, flows, transfers, evolves, or exchanges. Or, when chaos reaches a fatal stage, the system dies and is assimilated into another system.

The elements of the design give the structure its characteristics and limits the function of the system. In an atom, it is the design, the placement, of the elements within the atom that gives the atom its function. The rotation, direction of rotation, speed of rotation and degree of angle from each other are all important to its function.

The system of a particular atom must function to the desired design for it to remain stable and not fly apart into chaos. The design of each molecule is from its blueprint for a specific function. The function of the molecule(s) is determined by the design of the system in which it functions. All parts of a system’s design must take into consideration the bigger system of which it is a part for it to have the desired function.
The design aspect of an atom, a molecule, compound, organism, or organization, regardless of its size, is its blueprint. You may view the design, while it is more difficult to understand its function. Through examples of nature, you can see and understand that the slightest change in arrangement, change in the design, of the atoms or molecules has a drastic effect on its function, on its results. A simple example was covered in a science paper I wrote years ago in high school entitled, Two Deadly Poisons, Yet I Eat Them Daily. The two poisons are sodium (Na) and chlorine (Cl). Together (NaCl), they build an ingredient necessary for life. It is called salt. Sodium, by itself, is a system and has a function. Outside its design for a specific function, there is chaos. Chlorine, by itself, is a system and has a function. Outside its design for a specific function, there is chaos.

Together they (NaCl) form another system with a totally different function. Separately they are poison, but now together, by design, they function beneficially for all.

A working system contains a design made to achieve a specific function. There is no chaos in a system when the true design for a specific function is in proper timing at a precise location. Any flaw in a system will result in chaos if not corrected. Any flaw is caused simply by changing the function ever so slightly from its design. Or, any flaw is caused simply by changing the design ever so slightly from its intended function.

The next chapter is about communication between the systems.

Eventually, there will always be chaos within a system when the design does not match desired function. However, there is no chaos in a system when the true design meets with the specific function.
Quick Hierarchical Management Test: Rate yourself. Start with 100 points.

1) How many times in the last 24 hours have you become angry at an inanimate object? (Remove 3 points for each occurrence.)

2) How many times in the last 24 hours have you become angry at someone outside of your family? (Remove 2 points for each occurrence.)

3) How many times in the last 24 hours have you become angry at a family member? (Remove 3 points for each occurrence.)

4) How many times in the last 24 hours have you become angry at yourself? (Remove 1 point for each occurrence.)

5) How many times in the past 24 hours did you confess to yourself and another person that it was unwise to do #1 (Add 5 points for each occurrence.) (Note: You may clearly recall earlier actions to #1 going back in time on this and future questions.)

6) How many times in the past 24 hours did you confess to another that #2 was unwise and that you do not want to do that again? (Add 10 points for each occurrence.)

7) How many times in the past 24 hours did you tell the person in #2 that you were sorry and ask him or her to forgive you? (Add 15 points for each occurrence.)

8) How many times did you tell the person in #3 that you were sorry and ask him or her to forgive you? (Add 25 points for each occurrence.)

9) How many times in the past 24 hours have you told yourself that you were sorry, did not want to do that again, and actually forgave yourself? (Add 25 points for each occurrence.)

Note: If you did not have to subtract or add any points, now add 900 points. The object of this exercise is to reach 1,000 points.
Communication between systems

Within each design, the components store volumes of information, energy, and matter. Each system is designed to communicate with its different components and other systems with which it is to function. The communication may be physical, chemical, magnetic, electrical, or another means that is yet unknown. This communication initiates the exchange of energy and matter. Pathways of communication develop through neurotransmitters, receptor sites, transmission lines in the expanding form of wires, cables, pipe, nerves, arteries, veins, rivers, roads, water-ways, airways, or charted courses throughout space.
After the communication network is established, a transfer of information, energy, and matter is possible between components within the system and with other associated systems. The main function between components and systems is to flow Truth (no false signals), energy, and matter needed by the other components and systems.

The mind is a wonderful thing to not waste. When your brain believes wrong is right, it will sincerely make the wrong choice. I call that negative faith operating on false data. A hypochondriac may develop an illness in an otherwise-healthy body. The brain obeys the constant signals of welcoming illness because it becomes convinced that the signal is Truth. Not only is the single hypochondriac affected by this hidden lie, but others as well, including the family, friends, and community.

The brain obeys the signals it has been given. I believe even the DNA is made more susceptible as the neurons are trained.

Designed into the system are the harmonious seeking signals for checks and balances. When a component or system has a need, other components or systems come to the rescue even though it may mean their destruction.

Truth is the only communication. Anything less is miscommunication.

No communication is more trustworthy than miscommunication.

A little white lie ... is a snow job.
A Look at a Tiny system: If you think little tiny systems are not important, listen to the words of the Nobel laureate, professor Joshua Lederberg, PhD at Rockefeller University in New York City, "Our only real competitors for dominion of the planet remains the viruses."

A single virus is a tiny evil commando that doesn't eat, secrete, or propel itself. It is unable to reproduce without the aid of another living cell. The virus follows its pre-programmed instructions to reprogram the cells of another organism, making that organism the host.

By reprogramming the host cell, the virus causes that cell to become a traitor, directing it to cease its designed function and instead to replicate the invader, producing clones of the virus.

"The virus then seizes key positions in the host's body and spreads to other hosts-in-waiting at the first opportunity.

"Some viruses attack and disable their victims with cruel speed. ... Other viruses take years to harm their hosts. (HIV) can incubate for up to a decade, allowing the deadly agent plenty of time to pass to new hosts before its ill-effects become apparent. Others [viruses], such as herpes simplex, co-exists so well we're often unaware of their presence."

That was a quotation from Stephen S. Morse, PhD and Robert D. Brown. Dr. Morse was a virologist at The Rockefeller University in New York and is editor of two books, Emerging Viruses published by Oxford University Press 1993 and Evolutionary Biology of Viruses. Mr. Brown is a science writer and editor living in New Orleans at the time.
It has been said that the flu virus has a thousand lives. You can catch the flu many times over because of its prodigious capability to genetically change. The virus contains substances called antigens. Each viruses' antigens have tiny spots on their surfaces that fit onto a certain section of the antibody, similar to a key in a lock. Upon contact of an antibody with the virus, a command signal is given and the antigen is disabled, resulting in the disappearance of the flu symptoms.

Viruses mutate quickly. They do this by, changing their combination or signals. An ever-so-slight mutation of the antigens is all that is necessary to negate all the antibodies that have been resident for years. This enables the virus to infect you all over again and again and again. A new antibody must be produced to go after the newly-designed invaders.

Morse and Brown conclude that "if we don't take steps to monitor and contain their [viruses'] continual thrusts, one of their sorties could one day erupt into a global pandemic."

Any and all health challenges can cause the brain to not function at peak
performance. Addressing your overall health is an important step to thinking better.

Take the necessary steps to monitor not only what you put into your body, but what you put into your mind. The neurons in your brain will take over your whole system, be that good or bad. The information you communicate to your mind is what will control you. If chaos is present, it is because it was commanded into being. You have more authority over your body and over your circumstances when you understand the power of the communication between the systems.
Throughout the book, the word “function” is used to denote preferred performance.

Function is the “work” that can be accomplished because of the design of a system.

Many times, instead of the word “function” I could have used the word “work”. But, many people, especially some teenagers, think that is a dirty four letter word.
Familiar neurons fire when you near a familiar spot

Have you ever suddenly desired something that only a moment before you were not thinking about? Perhaps, you heard a word, saw an image, or got a whiff of a pleasant smell that caused you to have an impulse desire. This power of suggestion is what advertising is built upon.
The most powerful types of suggestions are those you have already programmed into your brain as acceptable. Habits are born out of entertaining familiar zones.

Discovering the Universal Memory Code may be science’s next mountain to conquer. They are close to understanding how the layers of thought are laid down over each other.

In one respect, the brain is like a computer: if wrong information is input, wrong evaluations will be made. The Universal Memory Code may be reduced to a formula, but if neurons begin firing when you enter a wrong familiar zone, they will attract more of the wrong thing. A mild, yet destructive, familiar zone may be a craving for an unhealthy food or looking at a moment of pornography.

Repeatedly choosing to enter a seriously dangerous familiar zone is a way to court disaster. This was exactly the result a few years ago when someone close to us got hooked on pornography and later raped a minor. Today, he is in prison while the suffering continues in the lives of those in the families he damaged.

A destructive familiar zone can be corrected; however, it will require serious work. I have personally found the best means of overriding a potentially-dangerous familiar zone is to meditate on a positive affirmation or Scripture that states how the challenge at hand will be overcome. Whatever you meditate on day and night will become your most familiar zone and habit.
Mental exercise in the familiar zone will develop your behavior, and your behavior becomes your character. Your character and your behavior all began with the little firing of the synapses of the neurons in the familiar zone.

A newly-invented photon device that fits on the head enables us to monitor synapses firing. The way it works is fascinating. Imagine you are in a chair and this photon skullcap is on your head. You are asked a simple YES or NO question. You correctly answer, “YES,” and a single area near the center of your brain fires synapses in a particular area.

Then you are asked another simple YES or NO question which you intentionally answer incorrectly. A single area near the center of your brain fires synapses, and then, in various parts of your brain, there are a myriad of sparks flying. Your neurons know the answer is wrong, and they are desperately attempting to reconcile or justify your response. The photon device is better than any lie detector on the market.

False signals make it so you do not know where you are going and that is where you are likely to end up. These false signals, sooner or later, develop into chaos.

Your neurons are HARD WIRED for truth, and truth is what holds all things together. A few years ago I wrote these words: Total Truth gives no false signals. The flow of even the slightest false witness gives the wrong signal and initiates the flow of wrong energy and matter. Opinions do not count as Truth. Because nothing is as it appears, what you perceive as reality is in fact, at least in part, an illusion. Untruth is an illusion paralleled with deception.*

For example, if twelve people see the same car wreck, each one of them will have a different perspective of that wreck which they each will perceive as reality, but which “is in fact, at least in part, an illusion.”
Albert Einstein based his theory of relativity on what he said was the fact that, “truth moves.” I do not believe that. Facts change, but truth does NOT move. Einstein used the example of people observing a pebble falling from a moving train. They perceived that the stone fall differently, from a straight line to different parabolic curves because of their perspective of viewing the falling stone.

Your neurons are HARD WIRED for that which is right – it is called your conscience. Each and every choice you make either enhances your conscience or dulls your perception.

So, everything you program into every neuron that is truth and right brings you to a higher level, a higher standard, of emotional peace. Everything that you program into your neurons that is not total truth or is not totally right brings you to a greater level of emotional unrest. Wow, what a wonderful safeguard you have built into your nervous system. You can fight it is you wish. That is called a bad choice and there will be a price to pay.

* It is not difficult for us to communicate our perception of something. It is, however, very difficult for you or me to perfectly communicate complete truth without variation. Examples are: All straight lines are curves when extended. All curved lines are straight when short enough. You cannot possibly tell me the exact time because it is changed before you tell me. The point is, absolutes are Divine.
False signals, sooner or later, develop into chaos.
A familiar spot is within the familiar zone. Entertaining harmful familiar spots develop traits that turn into habits which builds that type of character.

**Quick Familiar Spot Self Test**

I nicknamed this the Spot Check.

1) How many times within the last 24 hours do you remember passing a familiar spot?
   
   A. Did you give in to the familiar spot?
   
   B. Did you resist and overcame the temptation?

2) On a scale of 1 to 10 with the potentially harmful familiar spot (with 10 as the most dangerous), how would you rate each of the familiar spots you encountered within the last 24 hours?

3) Are you proud of your choices?

4) Have you chosen a close friend (possibly your spouse) to whom you are accountable?

5) Keep a weekly record and tell a close friend how it is working out.
A few years ago, I was teaching a class, and one of my students repeatedly positioned himself in a seat that enabled him to look out the window. Later, I learned that the reason he chose that seat was so he could view and lust after a liquor ad on a giant billboard across the freeway.
When his eyes contacted the colored picture of liquor in the attractive bottle, the **neurons** firing in his head lured him into a fantasy for **alcohol**. Liquor took him down because that was his propensity and he accepted it.

An **addiction** is initiated when you first entertain the allurement. Firing the **neurons** for the first time felt so good that you allowed them to fire again, and soon they were firing on their own.

There is no choice, no self-control, over the first firing of the **neurons**; however, you have a choice about future layers of **thought** put down over the initial **thought**.

There are two basic ways the neurons continue to fire in their effort to shape a **habit** that becomes a trait, a lifestyle and then your **character**. They are (1) to entertain the feeling repeatedly; or (2) just acquiesce. Not fighting the destructive impulse allows the neurons to fire at will. Acquiescence is approval in law and in life.

It is not the freezer that is transmitting a signal to come and eat ice cream. As you pass by the **familiar** zone, you trigger the latent desire that is imbedded in the **neuron(s)**. The number of **neurons** in which the desire is imbedded depends on how many you have trained.
How many times have you experienced a spontaneous desire? Someone says a word or you see an image which causes you to want something that only a moment ago was not in your thoughts.

You have learned that the power of suggestion fires neurons that, when entertained, fire again and again to form habits, addictions, lifestyles and character. If those habits are evil desires or addictions, they will continue to grow out of control and can never be satisfied with more of the same.

As additional neurons join the team to grow the addiction, other warriors are called into play. New signals summon changes in body chemistry; and when drugs or other toxins are added to the equation, they compound the problem. An example of chemistry change for compounding an addiction is the inhibiting of endorphin production in the brain.

I had the privilege many years ago, to get acquainted and become friends with, the late Dr. Meg Patterson, and her husband, George. Dr. Patterson, a Scottish surgeon, was a Fellow of the Royal College of Surgeons in Edinburgh, Scotland. She developed a new technology for stimulating endorphin production after the endorphins had been blocked by heroin, alcohol, cocaine, barbiturates, nicotine, tranquilizers and other addictive substances.

Dr. Patterson devoted herself to helping many people. She received wide endorsements from those she helped and friends of those she helped, including Keith Richards, Boy George, Eric Clapton, Pete Townshend, and many others. Sean Connery stated that her book “Getting Off the Hook” should be standard reading in any modern educational system.”
I personally witnessed different heroin and cocaine addicts have the desire for the drugs completely removed from their systems in ten days, with no withdrawal, by a re-stimulation of endorphin production through an electrical black box programmed for the addict's specific type of addiction. Electrodes were simply placed behind the ears at the base of the brain. The addict kept the electrodes on day and night for ten days.

Dr. Patterson proved that it is possible for the brain to change its propensity. When the addiction is strong, help is required to change for the better. Later, in my newsletter, I will tell you how a friend of mine has helped deliver hundreds of addicts from their addiction. In nearly thirty years, he has not had a single person go through withdrawal in order to be free of their addiction.

Also, in my newsletter, I will discuss a published paper that reports how addiction has been helped with certain glyconutrients. I envision an integrated strategic plan that doctors can use as the Optimal Propensity System.

It is my conjecture that if you want to lessen your sugar addition, you may want to use trehalose. My own sugar crave diminished dramatically was I began using it as my sweetener. Please give us feedback, should you see any health or brain function improvement. No medical claims are made or implied.

[www.EndowmentMed.org]
You have learned that the power of suggestion fires neurons that, when mentally entertained, fire again and again to form habits, addictions, lifestyles and character.
Emerging evidence is verifying that with repetition the neurons literally become hard wired to work. When the propensity is good, that is wonderful. When the propensity is less than good, that is called addiction.
Chaos happens when you confuse the neurons!

Every thought, word, or action is an Approach or a Reproach to a Gold Standard.

Every decision you make is either an APPROACH behavior toward or a REPROACH behavior away from that which is Truth and Right. Your conscience is speaking.
There is a Gold Standard for everything! The objective should be to have APPROACH behavior toward the Gold Standard in everything you do. With the standard in view, it becomes apparent that everything you do, every thought you think, every word you speak, is either moving toward the standard or away from the standard. The word “perfect,” when used as a verb, means “to mature.” You can become more mature in any subject and more mature in every part of your walk through life.

Your brain already has a standard, and you can choose to raise it to a higher standard. Every neuron in your brain knows the difference. An APPROACH behavior gives more peace, and a reproach behavior lessens peace. APPROACH behavior relaxes the nerves while a REPROACH behavior tightens the nerves. For many, a nervous breakdown is simply triggered by bad choices that negatively affect the neurons.

Your brain pre-judges things as they become known to you. Your awareness, your perception, your standard, is somewhat different from everyone else’s perception of the same word or subject.

You will agree, I am sure, that to be kind to another person is a standard that we should all have. Every time you are kind to another person, you are firing neurons with the APPROACH behavioral intent.
A thought, word, or action that is made toward the standard is an APPROACH that is recorded in the brain as a positive event. A thought, word, or action that is made away from the standard is a REPROACH that is a negative event.

Marcel Brass, PhD of Germany's Max Planck Institute and Patrick Haggard, PhD, of England's University College London find that a brain region just above and between your eyes - the dorsal fronto-median cortex (dFMC) - is specifically designed to let you pull back from doing something you were just about to do. Their findings were reported in the Aug. 22, 2007 issue of the Journal of Neuroscience.

Researcher Martha Farah, PhD at the University of Pennsylvania, who was not involved in the study, says the findings have major implications. Some subjects in the study had relatively weak dFMC activity, while those with better self-control had stronger dFMC activity.

As your will is exercised and the events are repeated, traits and character are established. Your level of self-control reveals your virtue.
Some brains are not fully developed. Some adult brains are not properly developed but nearly all teenage brains are lacking. The undeveloped area of a growing brain in teenagers is the dorsal lateral prefrontal cortex. This area of the brain is a critical factor in making decisions, solving problems and understanding the consequences for their actions. This is why it is so very important for the young people to be taught a higher standard. Here is a serious issue that can compound the problem. We should never take this discovery about the undeveloped area of the teenage brain and allow them to use this information to no be responsible for their own actions. That could slow brain development.

So the question is, “What standard is your conscience using, and what is keeping you from using the Gold Standard?” As you raise the bar, as you seek a higher standard, you will improve and grow emotionally. Your private world will become a better place, and collectively we will make the world a better place.

Imagine a sharp pain in your little toe. Do you see how that can, for a moment, affect the way you think and respond? The energy used in an attempt to solve the new problem distracts the brain for the moment. Your brain just prioritized its work load and became somewhat confused for the moment.

Now, imagine millions of neurons waiting for instructions from you to do something. You are at peace in beautiful surroundings. You have simple pleasant thoughts, and you already have many layers of wonderful references about the experience. Your neurons are waiting to process the upcoming thoughts with anticipation.
When an event or an impulse of any kind is perceived by your brain as NEGATIVE, that impulse adds to the negative calibration and masks over anything POSITIVE in a related area. Firing neurons without a positive purpose may actually dull neurons from perception.

There is cause and effect for the firing of every neuron in your body. Faulty communication may cause the firing of neurons at the wrong time or for the wrong thing. When the neurons misfire, it may be diagnosed as autism, ADhD, dementia or some other debilitating health challenge. The objective is to determine what is causing the problem and address it. Sometimes the source of the problem may be as simple as poor nutrition, either as a lack of needed nutrients or as an excess of something such as sugar or sweets.

Any dysfunction in synapses can play a major role in health. Dysfunction of the neurons is caused or compounded by toxins that become a part of the neurochemicals. Neurochemicals become toxic either from your environment or by your cells themselves generating the poisons. Stress through some dramatic event may cause or compound harm to the synapses by raising the acidic level resulting in more positive ions.

Feed your brain with good nutrition instead of junk nutrition and beneficial thoughts or harmful thoughts. All choices, all responses, contribute either to APPROACH or REPROACH. As we each raise the standard, our world will be a better place.
Your brain already has a standard. You can choose to raise your standard to a higher standard.
Memory Traces: Why they are powerful enough to determine your future!

What are Memory Traces?

Memory traces are recurrences of the firing patterns that occur when a memory is first laid down.
Memory Tracing utilizes what I call, “Schools of Thought” which I will discuss in another chapter. Memory Tracing is what happens within the “schools of neurons.” A cluster of neurons collectively take on a task.

Once a memory trace is prompted, a cascade of neurons responds like a flock of birds in flight. The neurons, working together in majestic formation, follow the lead neuron. They fire a spontaneous display of light while other neurons watch patiently nearby, awaiting instruction.

A hundred billion neurons or more can generate a virtually unlimited multitude of unique networks of memory traces. Each trace can lead to a virtually unlimited number of experiences from all of the senses.

Once a memory is stored, it may remain in storage for years. Or, it may be retrieved passively or vividly and then restored once or a million times. Do these patterns differ when time has passed following the event and then differ even more much later? How do false memories come into play? A lot of research is needed and will soon be done in this area.

Can it be that as memory is duplicated, errors occur? If so, what causes these errors, and how can they be corrected? Some of the information is blocked. This may be because the brain seeks to block out bad memories.

Even good memories are forgotten or “dropped” out of the dubbing process. When you reach back in time and retrieve a memory, you dub it into the present and the copy you recall may not be an exact duplicate of the event that was recorded live.
Dubbing thought may, in the process, bring with it “noise” interference from other neurons. Imagine billions of neurons watching the game but not actually participating. The neurons may be sitting on the sideline and not directed to play at that moment, perhaps because they are not experts in that game.

Later, we will discuss in more detail what scientists are learning about how the same information may be stored in many different pockets. As you learn the secrets of the brain, you can also learn better how to maximize your thought processes.

A dramatic event may cause a cascading effect to accelerate or block memories. The more favorable your overall good experience, the better it is for your entire nervous system.

Could it also be that toxins or poor nutrition can compound bad memories or even make up false memories? In another chapter, I will discuss in more detail the two basic types of toxins that contribute to spoiling the brain.

We have learned that gene expression is damaged (the DNA becomes corrupted) by toxins. David L. Busbee, PhD, head of genetics and toxicology at Texas A&M University, has demonstrated that proper nutrition can alter gene expression for the good. Dr. Busbee presented evidence of his work at two of our Glycomics Medical Conferences held in The Woodlands, Texas, near Houston.*
In my newsletter, I will look at findings at a major university to see just how and where in the cells of the body certain micro-nutrients can inhibit the onslaught of Alzheimer's Disease.

It has not yet been determined if consumption of regular sugar has any impact on memory tracing abilities. We are seeking feedback from any individuals who begin using the glyconutrient sugar trehalose (or family members and caretakers of those who begin using trehalose) as to whether you do or do not notice any improvement in brain function.

www.EndowmentMed.org

* Dr. Busbee’s presentation is part of a 14 hour Continuing Medical Education Credit course available on DVD. Available for CME or CEU credits for $299 with a 580-page syllabus on CD or to the general public for $199 without the syllabus. Order online at www.EndowmentMed.org.
A hundred billion neurons can generate virtually an unlimited multitude of unique networks of memory traces. Each trace can lead to a virtually unlimited number of experiences from all of the senses.
Don’t call another person stupid.

You can, however, recognize him as having a dullness of perception.

- Robert Hogan, my pastor

●

Don’t call another person an idiot.

He is a person with a peculiarity of expression.

- Noah Webster’s Dictionary

Devoid of good decisions
Improve the way you think!

My father taught me to question everything. I followed his advice and promptly asked him, “Why?”

My father, Cecil Spencer, challenged me to look at how things are done and to envision that there may be a better way. It was because of his encouragement that, all my life, I have looked for a new and better way to do things.
Training your brain to always be on the lookout for the best in every situation is the best brain game you can play. Conscientiously exercising your brain with memory tracing is one training mechanism you can utilize to better enable your subconscious to perform some of the memory tracing for you.

When your intent is honorable and you wish to accomplish a worthy objective, you can begin many possible pathways to achieving that objective. The most important and most difficult choices you will make in your life are not the ones that involve the simple act of choosing between good and evil – your greatest opportunity for significance in life will come when you choose between good and best.

We have learned that memory traces are recurrences of the firing patterns that occur when a memory is first laid down. More neural pathways increase the possibility of a more indelible impression in your memory. The more of your senses used to record the memory, the greater likelihood that the impression will last.

You may be unable to solve a given problem on the spot, but when you place that problem in the incubator of your subconscious, THE PROBLEM MAY BE RESOLVED “AUTOMATICALLY” SOME TIME LATER AND BE PRESENTED TO YOUR CONSCIOUS.
As the **INCUBATOR factor** is utilized over and over and it becomes a trait, your level of awareness is increased. You may discover that the limit to what you could accomplish has been lifted.

It is beneficial for you to better understand how your brain works. So, let’s play a little brain game with a peach.

What do you think of when you hear the word: PEACH? You have pre-programmed your neurons with peach information. Over time, you have accumulated a library of information on the peach as the peach has come in contact with your five senses of **sight**, **sound**, **smell**, **savor**, and **sensuality**. If you have, at some time in the past, experienced a delicious, tree-ripened peach, the following may be true: (1) From **sight**, you recall the beautiful color and shape. The experience was pleasant. (2) From **sound**, an impression was made as your teeth cut into the peach. The experience was pleasant. (3) From **smell**, you enjoyed the aroma. (4) From **savoring** the succulent flavor of the peach, your mouth **watered** for more. (5) When you first held the peach in your hand, you felt the velvet-like texture of the round fruit. As you bit into the peach, your mouth crushed the memorable piece of fruit and your hands were covered with the delicious juicy pulp running across your fingers.

If, on the other hand, the peach was picked green and **aged** in a gas environment, your peach experience produced a very different **memory**.

Firing more **neurons** to solve problems will enable you to solve bigger problems tomorrow. Solving problems, reading, working puzzles, and memorizing verses are excellent ways to **exercise** the brain. Reading the dictionary expands your ability in a number of ways. Make it enjoyable, and read for a few minutes at a time.
You can change the way you think by replacing junk food and junk thoughts with excellent nutrition and positive thoughts. Yes, train your brain to always be on the lookout for the best in every situation.

"Happiness depends upon the quality of your thoughts. Entertain no notions unsuitable to virtue and reasonable nature."

Marcus Aurelius
121-180, Roman Emperor
Use these mental exercise techniques to improve your brain function

You will find these brain exercises beneficial. Some of these techniques you may have never used before.
Some of the mental techniques are exercises you can do regardless of where you are. In fact, practicing these techniques in busy, noisy places or in traffic when your temper is beginning to flare may be just the places to work with these exercises.

You may find each of the lessons in this whole series of mind techniques to be individually beneficial. However, synergistically these techniques may give you extraordinary results. Expect off the charts and out of the box results by doing everything you can.

You are invited to participate in our Nutritional Pilot Survey and submit your findings to us. More information about the Mental Techniques to Improve Brain Function Nutritional Pilot Survey is available on our website at www.EndowmentMed.org. Click on MORE RESEARCH REQUIRED.

This chapter for improving brain function has little to do with good nutrition. I discuss that in other chapters. Here, I am focusing on what actually happens when you play these fun mind games.

Your attitude affects your brain, your whole nervous system, and potentially, every neuron and every cell in your body. I reached a major turning point in my own life when I consciously, and even verbally, took authority over my attitude. Today I respond to traffic challenges in a dramatically different manner than I did when I let emotion rule. I have discovered how vital it is to relax in the middle of challenges.
When an irritation came that could, and normally would, trigger a negative emotional response, I began to play a little mind game. I would meditate on something pleasant. Reaching back to when I was a child, I remembered times that I would become angry with my mother. Then I would remember what she would always tell me: “Son, just say, ‘Jesus, keep me sweet.’” Today, three score years later, those calming words still speak to me and play a role in my attitude. I have used that technique many times and it always, always works, when I LET it.

In my newsletter, I will explain what researchers have discovered about the enormous difference between the actual changes made within the DNA as a result feelings of anger versus feelings of peace.

Remember, you are dealing with neurons, and those very neurons are trained to be receptive to your will. They are at your command. No one has the power to make you angry unless you give them that authority.

Not only can your memory be improved with mental exercise, but your quality of life can get better in more ways than one.

Your neurons are trained to be receptive to your will.

Crossword puzzles are not only fun for a lot of people, they are mentally stimulating.

Monitor your mental activity. Designate a period of time, perhaps one hour. Take notes and tally the number of positive sentences you speak and the number of negative sentences you speak. Evaluate your own score. It can become either a good mind game or an unpleasant experience to ask a friend or spouse
(hopefully your spouse is a friend) to keep score between your positive and negative comments.

Crossword puzzles are not only fun for a lot of people, they are mentally stimulating. Working on jigsaw puzzles helps keep the mind alert.

In Alzheimer’s patients, one of the first areas of the mind that diminishes is the ability to work with numbers. Keep the mind more alert with mathematical calculations, remembering dates, and recalling old numbers out of the past.

Remembering numbers from the past can also trigger experiences associated with these numbers. I recall my family’s old phone number back in the 1950s and our P. O. Box from the 1940s. Those were phone number 731J3 and box number 302. The party line ring was 3 short rings. I cannot think of these old numbers without recalling many pleasant events of my childhood in Missouri. Some things have become hard wired into the brain.

**Do this little mind game in your head:**
Take 1000 and add 40 to it. Now add another 1000. Now add 30. And, another 1000. Now add 20. Now add another 1000. Now add 10. What is the total? *(The answer is in the Glossary under IQ Answer.)*

John Robert came into my office as I was writing this book and said, “Look at your foot.” I looked at him and he repeated, “Don’t look at me, look at your foot.”
I had my shoes off, so I looked at my foot. Then he said something that caused a cascade of pleasant memories to be triggered by looking at my foot, “Where have those feet been?”

Taking my eyes off my feet for a minute, I looked at John again and, “Nearly all over the world.” He knew that I was re-walking on the farm in Missouri, spelunking in different caves, trekking through Uganda, Kenya, Tanzania, India, the Middle East, walking inside the Great Pyramid of Giza, visiting Israel, traveling in the Orient, and touring the UK. I was instantly reliving wonderful experiences in the Canadian Rockies and seeing again the beautiful landscapes of the good ol’ US of A.

A world of memories were triggered by looking at my foot. Word association is powerful. You may not remember your first steps, but can recall many steps you have taken after those first steps.

Exercise your brain by taking a stroll where your feet have been. You will recall some wonderful experiences. Go back to your childhood and relive the good times. As you revisit and revive those memories stored in your neurons, enjoy and share!

A memory can prompt a cascade of neurons to respond like a flock of birds in flight. The neurons working together in majestic formation are following the lead bird.

Not only can your memory be improved with mental exercise, but your quality of life can get better in more ways than one.
Use mental exercise to improve brain function
Electrolytes play a major role in neuron conductivity

What are electrolytes, and how can they help your brain to function better?

Electrical currents course through your body nearing the speed of light. Your body operates under electrical power. Your nervous system is dependent on a combination of the proper flow of AC (alternating current) and DC (direct current). Without this electrical charge, your brain would not function.
Electrolytes play major role in neuron conductivity

Chapter 15

Your body contains a very sophisticated battery to power all of its functions including thought. When you feel “run down,” that is exactly what has happened. Your battery is low. Without electrolytes, you could not move, think, or live.

Electrolytes are in a gel or liquid of salts that conduct electricity. These salts are made up of certain minerals including calcium, chloride, magnesium, potassium, and sodium ions, which are essential for the flow of electrons and, of course, good human health. Because electrolytes contain essential minerals, they cannot be substituted in the diet. These minerals are absolutely vital.

Electrolytes are found in the blood, body fluids, and tissue. Electrolytes allows the body to have the proper pH balance that is essential for concentration, muscle coordination, heart function, and everything else the body does.

Electrolytes are responsible for hydration because they direct water-carrying nutrients to every area of the body, thereby maintaining optimal fluid balance inside the cells.

All batteries have a positive (+) and a negative (-) charge. You can have an acid (+) (low pH) battery. You can have an alkaline (-) (high pH) battery. For your body, the pH balance is an important factor. An example of this importance is the fact that cancer cannot survive in an alkaline environment.

Without electrolytes, you could not move, think, or live.

Electrolytes allows the body to have the proper pH balance.

When you feel “run down,” that is exactly what has happened. Your battery is low.

Cancer cannot survive in an alkaline environment.
Let me introduce you to two drinks that contain excellent electrolyte building blocks to charge your battery.

A natural acid electrolyte food contains a host of nutrients including phosphorous, cholerine, potassium, sodium, magnesium, calcium, sulphur, iron, silicon, plus many micro-nutrient trace elements. All of these electrolyte building blocks are found in pure raw unfiltered organic apple cider vinegar with the mother.*

About three or four mornings a week, I enjoy between one and tablespoons full of pure raw unfiltered organic apple cider vinegar with the mother. I place the vinegar in an empty cup and cover the liquid with two to four tablespoons of the sugar trehalose. The small mound of trehalose absorbs the vinegar into an amber liquid. Then I add hot water for what I think is a delightful morning drink. I slowly sip and enjoy this cup of pure healthy sweet tart Trehalose Vinegar Electrolyte. It is far better for you than a cup of coffee.
Another electrolyte that I put into my battery (my body) is lemon. I normally eat about two lemons per day. When my wife and I eat out, we almost always squeeze lemon into our clean drinking water which we carry with us.

You can easily make one of the most delicious and healthy drinks ever by simply making trehalose lemonade. Make it hot or cold. Here is how I do it. I squeeze one or two lemons (depending on their size) into an empty cup or glass and add enough of the sugar trehalose to almost cover the lemon juice. Then add hot water. If you prefer, you can use cold water. Trehalose dissolves more slowly in cold water; but once it is dissolved, it stays dissolved.

Lemonade made with the sugar trehalose is a good way to not feel guilty about giving your kids something sweet. Freshly-squeezed lemon juice contains magnesium, in conjunction with calcium, potassium, and phosphorus, plus other micro-nutrients, depending on where they are grown.

These trehalose home made drinks are actually Sports Drinks because of the fact they sustain energy and the fact that they do not stimulate a sharp insulin response.

The information in this chapter has not only helped the author think better, trehalose seems to have reduced my craving for other sweets.

* Mother of vinegar is that curious jelly-like formation of living bacteria and yeast which fosters the production of acetic acid. This gelatinous, slippery membrane while not appetizing in appearance, is completely harmless and does not have to be discarded. It can be filtered out using a coffee filter, or simply left in and ignored. A healthy mother can be divided without harm. Like yeast starter for bread dough, a vinegar mother develops spontaneously under the right conditions. The mother gives life to vinegar.
Lemonade made with the sugar trehalose is a good way to not feel guilty about giving your kids something sweet.
A free radical is a radical that has never been caught.
Free radicals damage your brain
Antioxidants fight free radicals.

It has been hypothecated for years that the death of neurons is caused by free radicals. Brain damage from free radicals has a direct relationship to how well the antioxidants are fighting the free radicals. Brain damage including brain cancer is on the rise and free radicals are the enemy.
Toxins in the air, water, and food build up over time and are the leading cause of severe mental impairment. Free radical damage has been observed in the brain of Alzheimer’s patients and may be the major factor in the development of beta-amyloid plaques and neurofibrillary tangles (two main neuropathological characteristics of Alzheimer’s disease).

A significant study reported at the World Alzheimer’s Congress found that “…people who remained free from any form of dementia had consumed higher amounts of beta-carotene, vitamin C, vitamin E and vegetables than the people in the study who developed Alzheimer’s disease.”

(The following is an overview of a Reader’s Digest article published on antioxidant and free radical research from the November, 2003, issue plus additional information from ongoing research. Studies verify that antioxidant function is vital to life. Optimal Antioxidant Activity Cannot Be Obtained in Normal Food and Must Be Supplemented for health and longevity.)

Dr. Bruce Ames has published over 450 articles and is one of the most cited scientists on the planet. In the 1950s, Ames was a researcher at National Institutes of Health (NIH). By the 1970s, he had developed the “Ames Test” for identifying carcinogens in pharmaceuticals, clothing, hair dyes and other items that come in contact with humans.
Scientists confirm that the rise in cancer is related to carcinogens. As the next step in understanding why the body falls apart, Dr. Ames theorized that the increase in free radical activity is related to aging. He began taking a closer look at the mitochondria, where free radicals are produced. The mitochondrion is a tiny generator inside a cell that manufactures energy for the body.

As a furnace hurls pollutants into the air, so does the mitochondrion pollute the cell depending on three main factors: (1) the quality of fuel burned, (2) the quality and amount of oxygen used in the process, and (3) the condition of the cell producing the energy to run the body. In a healthy cell, ninety-five percent (95%) of the oxygen used for mitochondrial function converts food into operational fuel. Oxygen is received primarily through the air you breathe and the water you drink. Without oxygen, to the mitochondria there is no igniting of the fuel, and consequently, no expendable energy.

Poor quality stoking fuel (junk food), poor quality water, and poor quality air are the evils that bring disaster to the cell. Mitochondria are magnificently efficient, but that efficiency is reduced by contaminated food, water, and air which causes them to spin off misplaced electrons called “free radicals”.

The mitochondrion is a tiny generator inside a cell that manufactures energy for the body.

25% of the oxygen you breathe goes to your brain. About 95% of your brain oxygen is used for mitochondrial function to convert food into operational fuel.
Free radicals do to the cell what rust does to metal. Oxidative stress is the result of cascading electrons bouncing, then bonding randomly within the cell. When these electrons bond indiscriminately, the result is electrolysis which bores holes into cells and cuts into the DNA. The radically-free electrons literally become chromosomal rototillers, which damage the DNA or electronically flip switches in the DNA at random. Studies indicate that damaged cells change, i.e. they morph, with mitochondrial DNA redistribution. Free radical damage may be THE cause for mutated cells, perhaps resulting in most, if not all, of today’s illnesses and deaths due to sickness.

When Dr. Ames was at the University of California in the 1990s, he and his colleagues discovered a crucial link between oxidation, DNA mutation, and aging.

They announced that free radical damage does not just increase with aging, free radical damage causes aging.

Damage to the DNA shortens the telomere. The telomere is a structure containing a repeated DNA sequence found at both ends of every chromosome in the human body. It was discovered in the 1990s that as a cell divides, the telomere keeps getting shorter. When the telomere becomes a certain length, it sends a signal to no longer divide the cell.

Without oxygen, to the mitochondria there is no igniting of the fuel, and consequently, no expendable energy.
A cell that cannot divide is called a senescent cell. A senescent cell is very much alive, but it simply cannot divide. This cell contributes to wrinkles, an aging look, and a tired feeling. When cells begins to malfunction, the immune system is compromised, soon resulting in chaos.

Scientists believe we can halt and even reverse the aging process. Author and research scientist, H. Reg McDaniel, MD, lectures on the science of reversing the bio-markers of aging. There is now a proven pathway to slow down the aging process. The new breed of doctors is recognizing that antioxidant therapy is the key to protecting each cell and possibly extending life.

A recent antioxidant comparative ORACo,* the state-of-the-art measurement, shows that many so-called “antioxidant products” have very little, if any, actual protection from free radicals. A report of the Antioxidant Comparative ORACo Test Results of 90 leading antioxidant products on the market has been published.

* The ORACo (Oxygen Radical Absorption Capacity) assay measures fat and water soluble antioxidant activity. (The older ORAC test measures only water soluble antioxidant activity.) See the Glossary for more detail.
This fact is to be burned into our minds:

Free radical damage does not just increase with aging, free radical damage CAUSES AGING.
How to better understand the Mitochondria

Clearly see a simplistic view of the Mitochondria, the powerhouse of the cell

The mitochondria inside the cell is vital for the final stage of burning of the fuel in the cell. Glucose and oxygen are the fuel. Oxygenation is vital to life, while oxidation is the “rusting” or destruction of life.
The **mitochondria** are the **cells’** power sources. They are distinct **organelles** with two **membranes**. Usually they are rod-shaped, however they can be round. The outer **membrane** limits the **organelle**. The inner **membrane** is thrown into folds or shelves that project inward. These are called "cristae mitochondrales." This electron micrograph is *taken from Fawcett, A Textbook of Histology, Chapman and Hall, 12th edition, 1994,* and shows the organization of the two **membranes.**

(Source: The University of Texas Medical Branch (UTMB))
Cancer in the brain, or anywhere in the body, may depend entirely on the ability of the mitochondria to make the final process of glucose conversion to ATP (adenosine triphosphate). A process called glycolysis occurs inside the cell in the cytoplasm just outside of the mitochondria where glucose is broken down into pyruvate. Pyruvate enters the mitochondria for conversion into Acetyl Co-A. The reaction is designed to produce hydrogen ions (electrons) that are used to produce the energy packets of ATP. Pathway optimization requires a proper amount of oxygen to burn the fuel so that free-radical electrons are left without anything available for the bonding process.

Another pathway for the conversion of ATP can be achieved without oxygen but may still produce free radicals by glitch malfunction. Backup systems were designed into the process. I have learned that system after system has redundancy backup support. That is critical when the first bodily system fails.

Two molecules of ATP are made from one molecule of glucose processed through the mitochondria reactor. Essentially four molecules are produced, but two of them are used up in the process of making the remaining two functional molecules. Obtaining the right amount of ATP to run all cell functions is the key to a healthy cell that is free of cancer-causing free radicals.

When fuel has the proper amount of oxygen to burn efficiently, bonding of free-radical electrons cannot occur.

It may be possible to lessen the free radical activity by cutting back on regular sugar, artificial sweeteners, and corn syrup sweeteners.
Researchers have produced strong evidence that mitochondria actually monitors oxygen concentration in the cell. When oxygen falls below a critical threshold, the mitochondrial "sensor" triggers protective responses to promote survival.

In the next chapter I will discuss in more detail the importance of getting more oxygen into our cells and ways that can be accomplished. While more oxygen IS needed, understand that the cell has the ability to sense and protect itself, up to a point, against hypoxia (low oxygen). Author, M. Celeste Simon, who is a Howard Hughes Medical Institute investigator at the University of Pennsylvania, said, "In the adult, changes in oxygen levels occur during inflammation and atherosclerosis; and even transient oxygen starvation can have a profound impact on the brain," said Simon. "For example, the well-known case of the late Terry Schiavo, in which a cardiac episode reduced her to a vegetative state, was the result of only brief oxygen starvation."

It may be possible to lessen the free radical activity by cutting back on regular sugar, artificial sweeteners, and corn syrup sweeteners and using the healthy sugar trehalose instead. Please give us feedback should you see any health or brain function improvement when you or anyone in your care begins using trehalose.

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The art of medicine consists of amusing the patient while Nature cures the disease.

- Voltaire
Oxygen is a double-edged sword:

Oxygen can make you shine or it can make your rust.
Oxygenation vs. Oxidation

Oxygenation, as discussed here, is simply the ways, the means, and the basic science for increasing the amount of oxygen you receive into your body and consequently your cells. Oxygenation is beneficial, while oxidation is destructive. Oxidation is the “rusting” of the system.

We will be discussing oxygenation only and H$_2$O$_2$ (hydrogen peroxide) therapy will not be a direct part in the scope of this work.
Obviously one of the ways for getting more oxygen into your system is to breathe deeply. That sounds so elementary. But, how many people do deep breathing exercises? Regardless of where you are, you can take deep breaths that will force additional oxygen into your lungs and your bloodstream. Oxygenation is one of the basic reasons for exercise, increasing the heart rate and deep breathing. You can do deep beneficial breathing exercises while driving your car, walking, or doing nothing but sitting or standing.

You know you are helping your body when you invest a few minutes just taking in as much air into your lungs as possible. This is one way you can expand your lung capacity. It comes rather naturally when you walk fast or do some vigorous exercise – could be why they call it aerobics. The dictionary states that the definition for aerobics is: physical exercise intended to improve absorption and transportation of oxygen.

Oxygenated water may be another possible pathway for getting more oxygen into the bloodstream. Some of the oxygenated water that I have been given or have purchased from our local health food store sure does taste good. I believe that if a major study were to be conducted on the benefits of oxygenated water, valuable information would emerge.
I have discussed how a higher pH (more negative ions) is beneficial and how cancer cannot even survive in a high pH environment. An acid environment is a lower pH. An alkaline environment is a higher pH. Negative ions increase the flow of oxygen to the brain, resulting in higher alertness and more mental energy, according to Pierce J. Howard, PhD, author of “The Owners Manual for the Brain: Everyday Applications from Mind Brain Research”, and director of research at the Center for Applied Cognitive Sciences in Charlotte, N.C.

Negatively-charged oxygen in the air and in water seem to play a role in tranquility and alertness. Have you stood near a waterfall and felt the peace and comfort? The waterfall is one of nature’s best-known negative ion resources. Other natural sources are lightning and air friction. This is why taking a shower not only makes your clean, but is truly refreshing when not highly contaminated with chlorine.

It is reported that the normal ion count in fresh country air is 2,000-4,000 negative ions per cubic centimeter (cm$^3$ is about the size of a sugar cube). At Yosemite falls, the normal count is reported to be over 100,000 negative ions per cm$^3$ while on Los Angeles freeway during rush hour, the level is below 100 per cm$^3$.

Negative ions break down serotonin and thereby give you a clear, alert outlook with a function of higher awareness. Scientists tell us that negative ions promote a higher mental awareness by increasing alpha brain waves. The ion-induced alpha waves create a clear calming effect. It is reported that European and Russian hospitals require ionization of air in their facilities.
Proper oxygenation aids the absorption of nutrients and gives the mitochondria the necessary oxygen to power the cell, and consequently, your whole body. As metabolism is enhanced, there is better utilization of nutrients and the brain becomes more intuitive.
Trehalose may put life on hold

Researchers are discovering how an apparently ordinary disaccharide helps plants and animals survive extraordinary environments.
Salvatore Magazu and colleagues at the University of Messina, Italy, have used a specialized spectroscopic technique to examine interactions between molecules of trehalose and water.

“The results could explain the unique biological properties of trehalose,” said the researchers, “which are not shared by other sugars with identical chemical formulae.”

Trehalose (C$_{12}$H$_{22}$O$_{11}$) is a common component in the cells of many plant and animal groups. It protects desert species from damage during periods of drought and can promote survival in extreme heat and cold.

Several theories have been proposed as to why trehalose exerts far greater protective effects than other disaccharides like sucrose and maltose. These include suggestions that its special properties are due to a higher glass transition temperature or that it forms direct hydrogen bonds with lipids in cells, replacing similar bonds with water molecules.

Magazu examined the bonds formed between water and all three disaccharides across a range of temperatures by collecting inelastic neutron scattering (INS) spectra. The authors describe how the beam of neutrons produced by a specialized spectrometer was used to measure vibration in the bonds formed between the sugars and water molecules.

The data show that trehalose creates a more crystalline formation with neighboring water molecules than that created between water molecules and the two similar disaccharides. “Trehalose modifies the structural and dynamic properties of water, forming a unique entity with water molecules which makes it better able to protect biological structures,” Magazu explained.
It's a nice experiment,' said Jane Vanderkooi, professor of biochemistry and biophysics at the University of Pennsylvania, US. ‘They showed that a trehalose-water complex is more rigid than other sugar complexes. This rigidity would protect against high temperatures. But looking at the water itself, the water molecules next to trehalose are more flexible than bulk water. This would protect biological molecules against cold, because it would be harder to form ice.’ John Bonner stated.

References

End of published trehalose paper.

Here is an interesting and healthy way for using the sugar trehalose. More recipes will be available in future newsletters.

Lemonade made with the sugar trehalose is a good way to give your kids something sweet without feeling guilty about it.

Squeezing a lemon into distilled water may be the ultimate way to drink lemon (you are adding the minerals with the lemon). But, if you want to make a really healthy lemonade, hot or cold, here is how to do it. Squeeze one or two lemons (depending on their size) into an empty cup. Add enough of the sugar trehalose to almost cover the lemon juice and then add hot water. If you want cold lemonade, you can use cold water. Trehalose dissolves more slowly in cold water, but once it dissolves, it stays dissolved.

(No medical claims are made or implied. No two people are alike and the health benefits may be different with each person depending on their nutritional need at the time.)
Trehalose may put life on hold
Why pH is so important

Positive, Negative, Low pH, High pH, Cationic, Anionic - what do these words mean?

Earlier I mentioned that all batteries have a positive (+) and a negative (-) charge. In fact, all atoms, all cells, all matter, all systems in all creation, have a positive and negative charge because an atom by design must have a charge.

The pH balancing act: Positive (+) = acid = LOW pH, which is cationic. Negative (-) = alkaline = HIGH pH, which is anionic. The pH is on a scale of 1 to 14. The pH scale measures how acidic or alkaline a substance is. A pH of 7 is neutral, less than 7 is acidic, and greater than 7 is alkaline.
When I was a young boy on the farm in Missouri, I was in charge of a half-acre garden. I learned the importance of a good soil pH at an early age. Soil that is too acid or too alkaline cannot produce a good crop. If the soil is good, then good seed will produce a good crop.

The pH scale is logarithmic, resulting in each whole pH value below 7 being ten times more acidic than the next higher value. For example: pH 4 is ten times more acidic than pH 5 and 100 times (10 times 10) more acidic than pH 6. The same equation holds true for pH values above 7, each of which is ten times more alkaline than the next lower whole value. So pH 10 is ten times more alkaline than pH 9 and 100 times more alkaline than pH 8. The two extremes (less than pH 1 or greater than pH 13) are extremely corrosive. pH 1 is like hydrochloric acid, and pH 13 is like caustic soda, sodium hydroxide, lye.

Frank Orme, Adjunct Biology Instructor at Merritt College says blood pH must be kept close to 7.4 in Mammals. Blood pH is set at a slightly alkaline level of 7.4. He says that a change of pH of 0.2 units in either direction is considered serious. Blood pH below 6.9 or above 7.9 are usually fatal if they last for more than a short time.

It appears that a good pH balance for water, blood, and soil is 7.4. The pH value may be the single most important factor you need to regulate. When the pH is not correct, none of the complex biochemical systems within your body will function properly.

7.4 to 7.5 pH is ideal for water, blood, and soil.
As a child, I envisioned one's soul as soil that needed to be prepared. I pondered the importance of carefully seeding it with proper nutrition and thought. If the soil of the body is good, if it is sown with good seed, and if it is properly watered, a good harvest will be the result.

A researcher whose life was invested in the study of pH in the body and how it affected overall health was Dr. Carey Reams. He pushed for a pH of 7.5. I will discuss this in more detail in another chapter and in my newsletter.

The soil is home for the seed and gives the seed LIFE. Blood is LIFE to the body. And, water is LIFE to the blood.

How fascinating it is to know that a pH balance of 7.4 to 7.5 seems to be about perfect for water, blood, and soil.

A high pH may be the ounce of prevention worth a pound of cure. It is exciting to see the mind set of many people finally moving away from: When it is broken, then the insurance will pay for the doctor to fix it.

Proper pH is a major KEY to your ability to enjoy a long healthy life. The body is best served when the blood is 7.5 pH with saliva and urine 6.4 pH. Dr. Reams reminded us that some of the worst culprits in our diets are refined sugars, grains, and the huge amount of acids in soft drinks.
Ion channel physiology affects every cell of the body. The neurotransmitter receptors regulate neuronal function by activating ion channels which excite or inhibit ionotropic responses. As an oversimplified example, think of a cell that is to acidic with + ions and the “help” that is coming is also + ions. The two + ions repel each other, but what is needed is ions that will bind. When a negatively-charged “helper” comes, it is much easier and more natural to obtain the beneficial ionotropic response. The receptor binding site now opens the gateway for the neurotransmitter and the transmembrane ion channel to “pour itself” into solving the problem at hand.

Capacity and Charge
Think of a high-storage-capacity battery that can hold enough energy to run your electric car from Houston to Dallas. Capacity alone is insufficient for the trip. You have capacity, but you must also have the charge. Without the charge of electrolytes, you could not live, move, or think.

The dictionary defines electrolyte as a liquid or gel which contains ions and can be decomposed by electrolysis. In other words, part of the battery is decomposed and must be replaced.

Dementia and aging occur as the battery gel is decomposed and not replaced. When your immune system and your hormonal system are working right, your battery will remain charged and the decomposing gel is restored.

The pH value may be the single most important factor you need to regulate for a healthier body.
Protein is the gel. Proteomics is the science of the proteins. Proteins consist of amino acids. Nitrogen and two hydrogens comprise the amino group, and the acid entity is the carboxyl group. Amino acids link to each when the carboxyl group of one molecule reacts with the amino group of another molecule, creating a peptide bond releasing a molecule of water.

Amino acids are the basic building blocks of enzymes, hormones, proteins, and body tissues. A peptide is a compound consisting of two or more amino acids. Oligopeptides have ten or fewer amino acids. Polypeptides and proteins are chains of ten or more amino acids, but peptides consisting of more than fifty amino acids are classified as proteins.

Until recently, scientists believed that the proteins held the key to nearly everything in human physiology. Then along came sugar and glycomics was birthed.

Scientists discovered only a few years ago that EVERY healthy cell is covered with glycoprotein receptor sites (made from specific sugars) for communication requesting the transfer of (1) more data, (2) energy, (3) nutrients, or (4) required chemical to perform a function.
Genomics is the study of the genes. The massive coding system within the DNA gave birth to the genome project. The discovery that all communication involves glycoproteins gave birth to glycomics. The glycome project appears to be thousands of times more complex than the genome project.
Schools of thought

The thought, “schools of thought” is not what you thought.

The expression “schools of thought” here has to do with schools of neurons in action.

John Robert is on our team. He and I have brain-stormed for thirty years concerning the brain and how thoughts are stored.
One day after John Robert and I read about the work of Joe Z. Tsien, professor of pharmacology and biomedical engineering and director of the Center for Systems Neurobiology at Boston University, as published in the July, 2007, issue of Scientific American, we began reminiscing about some of our discussions from past years.

The work of professor Tsien confirms some of our earlier hypotheses. His team focused their research on the hippocampus area of the brain and the CA1 region in particular.

This research team proved that, indeed, “cliques” of neurons work together. Since the neurons are in a liquid or gel, I called them “schools” and “schools of thought”. Professor Tsien’s words are, “... we found that each specific event is always represented by a set of neural cliques that encode different features ranging from the general to the specific.”

Depending on the type of event, different cliques of neurons go into action collectively in concert. This prompted the chapter on Memory Tracing where John Robert inspired the thought:

“Once a memory trace is prompted, a cascade of neurons responds like a flock of birds in flight. The neurons working together in majestic formation follow the lead “bird.” They fire a spontaneous display of light while other neurons watch patiently nearby “on the bench” awaiting instruction.”

It is fascinating that when a school of neurons responds to an event or a subject, the neurons become trained to handle that situation or subject. It is that same school of neurons that responds over and over to a given event or familiar zone.
I quote professor Tsien, “The CA1 Region of the hippocampus receives input from many brain regions and sensory systems, and this feature most likely influences what type of information a given clique encodes.”

Many serious illnesses are triggered by a painfully dramatic event of some kind. It is often reported that a health challenge started right after a fall, a wreck, or some rather shocking circumstance.

Imagine a possible dramatic event. You fell on the ice and you had on a red jacket. Your car was blue and the radio was playing a familiar song. A small child in sunglasses dressed in pink was standing nearby. This memory is stored indelibly in your school of thought. The pain was there. The event was real. I am not talking about hypochondria.

The school of neurons remembers details of the event. Weeks later you go to the refrigerator and put ice in your glass. The school of neurons remembers the ice and replays the event. You again put on your red jacket and the neurons go into flight. Every time you see ice, a red jacket, a little girl, sunglasses or a pink dress, the neurons are dancing around wondering if there is anything they can do.

Remember, the neurons are here to help you. They have been programmed for right, for truth, and for solving the problems you have at the moment. Neurons thrive on thought. They need the nourishment of new thoughts served on the platter of physical nutrients. Relax and tell your neurons to do what they were designed to do.
Neurons thrive on thought.
Cultural change @ warp speed

It’s best if you use your brain!

Imagine you have been asleep for 40 years and you have just awakened. The cultural change would be overwhelming. Now, compress that much change into the next few years.

Technological, political, and moral change can occur without your being aware of it. An awakening causes you to contrast the past with that which has been mutated before your eyes.
Change is coming at you at warp speed. You are in trouble if you are not prepared. Change plays favorites only with those who are prepared. Change ruthlessly destroys cultures that don't adapt. Change will develop greater character in you, if you let it. You can adapt to the coming change by relearning to think like a child.

Childlike flexibility is needed to communicate, survive, and excel in the coming cultural shifts. Children adapt to swift changes better than adults. Children, bored with non-change, will make change. A little child, loving to learn, will forge out new frontiers of novel experiences.

An explorer by nature, a little child opens the door to the unexpected with curiosity. The adult, attempting to use his head, beats it against the wall of change. The child, using his heart opens the door and walks into his new-found venture. The child, trusting his creative instincts, moves forward while the adult, trusting what he knows, is bogged down in his own skills and old “solutions”.

Holding on to something because it is what you feel comfortable with or because it has always been done that way is not good. The time to dig your heels in and resist change is when the change is being presented in an attempt to move you away from a standard of absolute truth. Only when you are able to hold on to the standard of absolute truth while embracing changes that allow for growth and a greater understanding of that truth can you make positive changes and right choices.

Change plays favorites only with those who are prepared.

Children adapt to swift changes better than adults.

Your prepared ability to make necessary changes, will result in right choices.
Focus on the truth of what is and what is to come and how you can make a difference. Truth will set you free and give you peace in the middle of change. If you fight change, you will make bad choices requiring even greater radical change. Relaxing in the middle of change re-leases positive development that renders quick responses toward good results.

High-velocity change requires faster response time that may, for a moment, require radical behavior adjustment to excel in the change. Since truth is the real winner, does your belief system need adjusting more toward total Truth? Your priorities, your responses and reflexes can improve as you raise the standard of what is always right.

Change is like a train passing by. It is difficult to catch a fast-moving train when you are standing still. It is easier to catch the train if you are running the same direction as the train. The train is easiest to catch when you are moving parallel with the train at the same speed in a vehicle or on a moving walkway. Develop a rapport with change. Think how it can help you.

Keeping up with change requires a determined acceleration in a dedicated positive direction plus elimination of practices that have bogged down your productivity. Cast off extra weights and bureaucratic patterns and streamline your flow of communication to help you keep up with change.

Develop a new rapport with change.

The key is in your response.

Truth will set you free and give you peace in the middle of change.

Change can consume your energy, or you can synchronize with change to acquire additional strength.
Price Pritchett, in his book, “Culture Shift” said, "Slowing down gives you the feeling that you're safer, more in control. But the feeling is false. Picking up speed protects you better in today's world of high-velocity change."

Embrace change and change loses its power. Positive change, when it allows you to maintain the standard of absolute truth, is not the enemy. To fight change is to enter the arena of defeat. Change can consume your energy, or you can synchronize with change to acquire additional strength. Focus your thoughts and choke off negative influences. Develop a passion for positive results. With the agility of an Aikido artist, you can disarm change so its motions are directed to your advantage. Invest your energy and the energies of others toward solutions to problems.

Change may bring with it illusions that you have lost control of your own destiny. This is the time when you cannot afford to bring haphazard, frantic responses to the situation. Cast off fear, and focus on the objective. Don’t wait for someone else to decide for you. Exercise self-control of your own behavior.

Status quo just got run over by change. Security in the norm is about to be laid waste. Tradition, stuck in the rut of history without the courage to take risks, is consumed by her own practices. Change brings with it the opportunities to be different, to be adventurous, to extend yourself and reach beyond what others have done.
Change may require you to lay down your greatest strengths and abandon your best talents. Your greatest strengths will become your greatest weaknesses unless your behavior is modified to the change. Your weaknesses can become your strengths as you acquire the energy brought by change. Develop new skills. Develop new directions. Adapt to the changes, and your undeveloped weaknesses will outweigh your outdated strengths.

Change gives birth to problems for someone to solve. Solving a problem may take less energy than complaining about it. There are many problems designed just for you to solve. The pessimist worries that there is not enough problems to go around. Raise your standard of excellence in the middle of change by helping others overcome their problems. THAT’S WHY YOU ARE HERE! You know how to solve certain problems better than anyone else. Accept the position of solving problems, problems closest to you. You can make a world of difference.

The more change, the more problems, the more opportunities for solving problems. As you bring your higher standard of character into the change, you help correct wrongs and change becomes easier. Search out easy solutions. Simplify problems by eliminating unnecessary steps. Be innovative by making a radical change to find a better approach.
How you respond toward good change or bad change reveals your character and will contribute a positive influence into the change. You can accomplish today what your forefathers could not do in a lifetime. You are living in the most interesting time in all history. Take advantage of that wonderful blessing.

You will be remembered for the problems you solve or the problems you create.
It may take less energy to solve a problem than to complain about it.
"When plans are laid in advance, it is surprising how often the circumstances fit in with them."

- Sir William Osler
1849-1919, Physician
The Savant: Proof of brain capabilities

Hidden potentials are buried in the mind of the savant.

The four-minute mile was considered an impossible feat until Roger Bannister ran the mile in 3.59.4 minutes on May 6, 1954. Soon after that, other athletes ran the mile in less than four minutes.
When an “ordinary” person accomplishes an extraordinary feat of any kind, it proves that it can be accomplished and shows the way for others to do it too. You have unique capabilities that others may not have. Perhaps those abilities lie dormant in your brain. What will it take to bring them to life?

The movie *Rain Man*, starring Dustin Hoffman, became the classic savant story. It is based on the life of savant Kim Peek. The movie made us all say, at least in our hearts, “*I wish I could do that!*” We are in search for the savant in all of us. The word savant is French, meaning a learned person.

The four-minute mile was run in the brain before it was run on the field. Motor skills are made possible by brain function. The Parkinson patient may have all his or her mental capacities, but the motor skills are either helped or hindered by the brain function.

The first movie footage I studied about a savant was called *May’s Miracle*. It is the story of Leslie Lemke and the love and care he received from his mother, May. She was given this – if I recall her words correctly – “*blob of flesh,*” that was blind and would never walk nor talk.

May loved her little baby boy, and through love, touch, caring and music, yes music, Leslie began to respond. It was evident that he enjoyed hearing beautiful music. She would play records and she would play the piano; Leslie would sit and listen.

Then one night, in the middle of the night, May and her husband heard something in the living room. Leslie was playing the piano with his crippled hands. He was playing the most beautiful classical music, note for note, that he had been listening to on the records.
Later, before he could talk, he began singing, singing songs in the voices of the musicians he had heard on the records. His Louie Armstrong voice seemed identical to the original, as did his other voices. The music became programmed into Leslie's brain, which was otherwise not working properly.

Savant Syndrome is a very rare, but spectacular condition. All savants do not have serious disabilities as Leslie Lemke did. Savants can, indeed, be called, “islands of genius”.

Some savants are human calendar calculators who can tell you the day of the week for any date past or future. I recall one savant man who developed the capability after he injured his head. It was fascinating; he could do any calendar calculations in the future, but past dates only back to the date of his head injury.

Another man is compelled to sculpture clay and produces with his hands phenomenal works of animals.

Savants can, indeed, be, “islands of genius”.

Savants may display remarkable gifts and talents in music as well as in art on canvas or in sculpture. I recall the artist who could look at a tall building, then later from memory render a precise pen and ink drawing of the building in perspective with each window in place. He was flown over Rome by helicopter and later rendered an aerial view of the city with the buildings in perspective reproduced from one of his “memory snapshots”.

Savants may display remarkable gifts and talents in music as well as in art on canvas or in sculpture work or mathematics.
As you better understand Savant Syndrome, you can better understand the human brain. There is intriguing scientific interest in the world of the savant, and it is my hope at The Endowment for Medical Research to explore how some of the traits of the savant can be explored to help all of us tap into our potential and help you Expand Your Mind - Improve Your Brain.

Savants somehow tap into a pool of intelligence in a way that most people cannot fathom.

If you or someone you know were dropped on their head (or had a dramatic event), look for the good in that. Should any rather remarkable abilities come out of that, please send comments to us.

In the next chapter I will cast my net on the right side of the brain and see what I can bring into the boat. I am expecting a large school of neurons that we have not yet had the opportunity to examine closely. They will tell us their thoughts.
“Don’t ever let anyone tell you that something is too competitive. Once you subtract the people who don’t work very hard, or the people who aren’t as good as you, your competition shrinks dramatically.”

- Maggie Mason
The neural pool contains many schools of neurons
Cast your net on the right side of the brain.

In Chapter 21, *Schools of Thought*, I likened a pool of neurons to a flock of birds in flight working together in majestic formation following the lead bird. Think of 100 billion neurons in action at your command and controlled by your thoughts.
In Chapter 23, *Proof of brain capabilities: the Savant*, you discovered that the savant is able to access schools of thought that others have not yet been able to reach. Those regions of the brain, those schools of neurons lie dormant in most brains awaiting an awakening.

It is within this school of thought, this pool of neurons, that we will find the answers to advanced ways in which the brain can function. It has been done. Now, let us do reverse engineering.

While it appears that the “damaged brain” is a part of the life of the savant, that is not always the case. A few savants appear quite normal and even have social skills. These “more normal” savants move us closer to understanding that some of the ways of the savant may be the way it should be. Perhaps it is the rest of us that are not “normal”.

A lot of things are going on in your brain at all times, including when you are asleep. Your remarkable cells are constantly protecting you, securing data, backing up programs, fixing things, and working on solving any and every problem you have.

There is evidence that different areas of your brain are networked together to help process information. These connections lead to pools of neurons that hold a world of answers. Every experience you have ever had in your whole life, by utilizing what I call the seven senses, is stored in your brain. The seven senses, or seven gateways to the mind, are sight, sound, smell, savor, sensuality, soul, and spirit. Everything you have ever seen, heard, smelled, tasted, felt, or experienced with your personality, and experienced with your Lord, is buried in your brain.
Some connections are better than others, and therein may lie a big part of your neurological network problem for a better recall system.

Daniel Tammet, in his twenties, is super-intelligent and a highly-functioning savant. He has many of the traits of autism but is able to describe his relationship with numbers and language. Daniel can do complex calculations in his head. His answers take the calculations to decimal points far beyond the scope of common calculators or even computers. He did a battery of random tests with neurological researchers.

I saw his remarkable presentation where it took him five hours to recite the value of Pi to the 22,500th decimal point. He took a break halfway through and just picked up where he left off. He handles different languages and learned the Icelandic language in just seven days before appearing on a live talk show in Reykjavik to speak with the hosts in Icelandic.

Daniel's abilities first manifested at the age of 4, after suffering a series of violent seizures. Some scientists theorize that a dramatic event can actually "rewire" the neuron network in a way that it becomes connected to specific areas. These schools of neurons enable the savant to govern his abilities with a photographic memory, and skills with numbers, mathematics, music, or art.
For you, some of the schools of neurons are so deeply buried in your memories that you cannot recall them. For the moment, you have forgotten and just cannot remember where you put it. Some of your neurons know where the school is, and some of your neurons are the library where the books are stored.

As you learn the secrets of the brain, you can also learn better how to maximize your thought processes. More neural pathways increase the possibility of recalling the indelible impressions in your memory. The more of your senses used to record a memory, the better the opportunity for making a lasting impression. The same is true for recall. Have you ever forgotten why you went to another room to get something? And, when you went back to where you were, your recall worked?

Distraction is a negative power which blocks brain function. One of the worst distractions is saying negative things about yourself or your abilities. Negative confessions block success on all levels. If you think you cannot do something, you are right. If you think you can, you are right. The longer you continue to believe and say that you cannot do something, the less likelihood there is that your belief can ever be changed. If we would all believe in the potential that we have inside of us, we would have a new culture of consciousness based on hope, faith, righteousness, truth, and justice.
"Life is too short to spend your precious time trying to convince a person who wants to live in gloom and doom otherwise. Give lifting that person your best shot, but don't hang around long enough for his or her bad attitude to pull you down. Instead, surround yourself with optimistic people."

- Zig Ziglar
The neural pool ... many schools of neurons
Improving the brain through resistance

Resistance produces results otherwise unattainable. The right amount of resistance can save your life.

Resistance should be looked at as a blessing rather than a curse. Without resistance, your body would be weaker, your mind less alert, and you would not have electricity.
In fact, when you look at any circumstance, any event, and can see the potential good that can come from it, you will be better for that attitude.

Look at the electric generator. Regardless if it is tiny or a giant dynamo capable of supplying electricity for a city, the same principle applies. The generator can turn rather freely when there is no resistance. The moment you turn on a light bulb or begin to draw any power from the generator, resistance kicks in. The more energy taken from the generator, the harder it is to turn.

The law of resistance is an inevitable law of physics, science, nature, human nature, and all that has function. You cannot get away from resistance. To resist resistance is to compound resistance.

When I was twelve years old, I had my starter laboratory; and by the time I was in high school, I had converted my bedroom on our farm in southwest Missouri into a chemical and electronic laboratory.

As a child, I remember building a device that included an electric socket with 100 watt light bulb. Instead of a switch,

I had two insulated probes that I dipped into a glass of water. As I added salt to the water, the lightbulb began to glow a little. As I added more salt, the bulb got brighter; and soon it was burning near the 100- watt capacity.

To me experimenting with resistance was not only educational, a time or two it was rather shocking. I knew that a 100 watt light bulb had the resistance of allowing 100 watts of electricity to pass through it while a small 7 watt light bulb had greater resistance and would only allow 7 watts of electricity to pass through it.
My father, years earlier, had purchased an electric fence charger to keep the animals in a field; but we needed another one around a ten-acre pasture to keep in our young bull calves. I told daddy that he did not have to buy another electric fence charger that I would build one that would not cost over one cent per year to operate.

I used 110 volts of electric current for my device which was simply a 7-watt lightbulb mounted on a board. I only used the “hot wire” to the lightbulb with no ground wire. The ground “wire” would literally become the ground when anything touched the electric fence around this ten-acre field, and thus, keep the bull calves in. When weeds grew up and touched the insulated fence, the lightbulb would come on until I found the short and cut the weeds. The resistance would only allow 7 watts of electricity to the fence which was not enough to kill anything but would give them a mild shock which worked perfectly until the bulb got broken. Now, for an example of what you can lose when you do not understand resistance.

My father had not quite understood the principle of resistance that I had used to build the electric fence. He replaced the broken bulb with a readily-available 100-watt bulb. Of course, when a bull touched the fence a few days later, it was killed instantly. I remounted the 7-watt bulb socket on the underside of a large jar lid, nailed the lid to the top of a fence corner post and screwed the glass jar that matched the lid to protect the device from the weather and my father. The price my father paid to learn the lesson on resistance was a young registered show animal.
The right amount of resistance is critical. The amount of resistance must fit the design and function. The purpose behind the design and function of all creation is that each part is to operate in harmony with the other parts.

There is a great lesson to be learned when we make the connection between pH balance, resistance and expanding your mind and improving your brain.
"In every success story, you find someone who has made a courageous decision."

- Peter F. Drucker
  Management Consultant
  and Author
Neurons, pH, and resistance

Until you read the previous chapter, you may have looked at resistance as something negative. However, we now know that the right amount of resistance is critical for all function. The design and function of all things require a specific, pre-determined amount of resistance for optimum functionality.
In an earlier chapter, I discussed how the soil is home for the seed and gives the seed LIFE. Blood is LIFE to the body. And, water is LIFE to the blood. It is, indeed, fascinating that a pH balance of 7.4 (or possibly up to 7.5) seems to be about perfect for water, blood, and soil.

The effect of soil pH is great on the solubility of minerals or nutrients. Too acid or too alkaline is damaging to the soil and plants. Different pH soil absorbs different minerals. Too low of a pH (acid) makes aluminum soluble into the plants. Too high of a pH (alkaline) can cause a problem with the availability of iron.

I submit to you that if the soil, the blood, and the water you drink were balanced according to their original design, that EVERYTHING would be greatly improved from where it is today. When the blood is “right,” it goes a long way to making your body chemistry “right.” When the soil is “right,” it seems reasonable that the plants would come nearer to being “right.”

Your body is probably too acidic. Most of the foods you eat are too acidic. The soft drinks you drink are acidic. The soil is too acidic. Your blood is probably too acidic. So, where does “resistance” come in?

Here is the dictionary’s definition for the word alkalinity: “Alkalinity is the measure of a solution’s resistance to changes in pH (higher or lower). It is commonly measured as carbonate alkalinity or total alkalinity, and is expressed in meq, dKH, or ppm of C03 ions. Alkalinity can be raised by adding a buffer.
In soil, the buffer used to increase the pH is lime. The addition of lime replaces hydrogen ions and raises soil pH, thereby eliminating most major problems associated with acidic soils. Lime also provides two nutrients, calcium and magnesium to the soil. In addition, lime causes phosphorus that is added to the soil to be made more available for plant growth and increases the availability of nitrogen by hastening the decomposition of organic matter. Liming materials are relatively inexpensive, comparatively mild to handle and leave no objectionable residues in the soil.

For your body, the type of buffers modern medicine recommends are anti-acids. Unfortunately, they lower the acid in the stomach, where it is needed, rather than in the blood. The solution is to improve digestion, but anti-acids generally lessen the body's digestive abilities. Consult your physician to find out if digestive enzymes and probiotics might be a better choice.

Some health specialists are saying that drinking more lemon juice is a way to increase your pH.

Books have been written about the benefits of lemon, and too often the writers have assumed that ascorbic acid has the same benefits. It does not.

Scurvy and many diseases are caused simply because the enzymes needed have been killed off by the low pH in the blood and your whole system. The British sailors no longer became ill during long voyages at sea once lemons or limes were carried onboard, and sailors were required to eat one per day. This solution to the scurvy problem is how the English sailor became known by the endearing term “Limey.”

Scurvy develops when humans cannot synthesize vitamin C. Lacking is the enzyme L-gluconolactone which converts L-gluconogam-malactone to L-ascorbic acid. Vitamin C is also essential for collagen synthesis. Any deficiency will affect any organ or structure that requires collagen.
The National Library of Medicine and the National Institutes of Health (NIH) at www.PubMed.gov currently list over 117,000 references to papers dealing with collagen. The lemon may not only help raise the level of the pH in the body, but consequently, may address many health challenges including ways to **Expand Your Mind - Improve Your Brain**.
Neurotransmitters are at the heart of cognitive science. The brain IS neurotransmitters.

You probably have 100 billions neurons in your brain. I hope so. Each cell reaches out to touch other cells through its axon. Each neuron is connected to hundreds of other neurons by way of as many as ten thousand synapses.
If you attempted to calculate how many synapses are in your brain, you would discover it is as incalculable as the sands of the seas or the stars of the heavens.

Gerald Edelman, biologist and Nobel Prize winner for his work on the immune system, went so far as to say that just counting your synapses would take thirty-two million years. In other words, you have a lot of activity going on in your brain. And, the number of synapses you have is probably increasing. Gary Lynch at the University of California, Irvine, confirms that new synapses are added as you learn.

Neuroscientist and brain researcher, Dr. Ira B. Black, stated that the density of the brain is measured by the number of synapses. The greater the density, the greater the mental capacity.

Pierce J. Howard, PhD, in his second edition of The Owner’s Manual for The Brain (1999) says, “Today we regard the synapses as the structural center but acknowledge that vast coequal player in the learning process. The number of synapses and their condition, the circulatory system, and the cerebrospinal fluid form the state upon which (y)our electrochemical language plays out its drama. The alphabet of its physiological language is composed of over TWO HUNDRED LIGANDS.” (emphasis mine)

Ligands are manufactured by nerve cells, immune cells, and other cells that play a role in the development, function, maintenance, and operations of synapses, neurons, and other organs. The 200 ligand alphabet forms “words” of instruction for different behaviors.
I will not attempt to cover here the magnitude of how the ligands control neurotransmitters through excitement, activation, and inhibition. The function of the ligands helps us better understand the role of electrolytes and micro-nutrients discussed in earlier chapters. (The word “ligands” is from Latin, meaning, "to tie or bind.") Ions or molecules that bind to transition-metal ions form these more complex ions that make up the coordination numbers. This complex electrochemical language controls the neurotransmitters that control your mind and body.

The more you understand the brain and mind, the more you will soon discover that we know so very little. Our objective is to set an impossible sight of complete understanding. New insights will not come should you settle for anything less. Over the next few years, I expect cognitive science to make major strides with discoveries that will shock the scientific world. I will be presenting some of my hypotheses in future newsletters.

Dr. Black wrote, “Synaptic communication is a remarkable flexible and changing process, subject to modification by intraneuronal, extra-neuronal, local micro-environmental and even distant regulatory mechanisms.”

The number of neuronal states for a single neuron may range from under 100 to 10,000. The power of these numbers are off the charts and can literally direct the cells to manufacture in a split second virtually any chemical known to man from highly toxic chemicals to endorphins to make you sleep like a baby.

Protein plaque buildup has been determined to be one of the causes of Alzheimer’s and dementia. In another chapter, I will deal with cleaning the synaptic gap for better firing. Cleaning a sparkplug with a wire brush is a little more crude than cleaning a synapse, but scientists have learned how nature cleans the synapses.
The care and feeding of neurons

Nerves and blood vessels enter the brain through holes in the skull called foramina. This is how nutrients and oxygen are carried to the brain. These blood vessels are found over the surface of the brain as well as deep within the brain.
Your brain is at the top of the list for blood supply. The brain is about 2% of your body weight; however, it receives 15-20% of your body's blood. Oxygen in the blood is the brain’s life support and utilizes 25% of your whole body’s oxygen consumption. Your brain cells will die rather quickly if your blood supply is cut off. However, local flow-rates of oxygen vary, depending upon which part of the brain you are using at any given time.

Your blood carries in the materials necessary for the brain to function properly and carries out waste material as it exits the brain.

While the brain is highly metabolically active, it has no effective way for storing oxygen or glucose. Your brain relies entirely on a large and stable blood supply.

The Blood-Brain-Barrier (BBB) keeps most contaminants out of the brain, and it has a number of highly-selective mechanisms for transportation of nutrients into the brain. Only smaller nutrients get past the BBB.

Studies at the University of Arizona help us understand that diffusion of nutrients into the brain are divided into paracellular (between cells) and transcellular (across cells) diffusion. Membrane permeability is an important factor. Non-electrolyte and negative ions versus positive ions make a big difference here.

Proper nutrients = proper pH = better brain function
The net movement of a solute with the same charge as the membrane is thermodynamically unfavorable, due to mutual repulsion of ions. A little higher pH (negative ions) account for greater membrane permeability.

Various papers from different universities and notable professors point to the fact that many brains have a pH of 7.1 to 7.2. This seems to be what may be called “normal”. In my quest for the perfect pH for the brain, I am using 7.5 as where I would like to go.

Some of the nutrients you are feeding your brain are transported past the BBB. When these nutrients are non-electrolyte or have the same ionic charge as the cells in the brain, the membrane permeability is inhibited. When the nutrients you are feeding your brain are a higher pH, there is easier membrane permeability. (You may want to refer back to the chapter entitled, Why pH is so important.)

The fuel – nutrients – on which your cells operate needs to be a higher pH fuel than you are probably putting in your body if you want to lower your level of acid and toxins. But poor fuel is not the only enemy causing acid and toxins.

There is another source of acid and toxins in your body. Stress causes your cells to manufacture acid. Worry, doubt, fear, and anxiety cause your cells to manufacture acid. I will discuss more in my newsletter what these negative factors do to the DNA. It is major.
It is easier to shift toward acid than it is alkalinity because your body is naturally more acid. Shifts in the pH can occur within milliseconds.

My quest toward a 7.5 pH has been partially reconfirmed in different papers from a number of universities and experts in the field of neuro-science. Remember, you want to positively excite the neurons to improve brain function. The papers I have studied can be summed up with a quote from the Department of Physiology and Neuroscience, Department of Neurosurgery, New York University School of Medicine, New York, New York, in a paper prepared by Mitchell Chesler entitled: Regulation and Modulation of pH in the Brain. The quote is: "Enhanced excitability has long been associated with a rise in pH, while acidosis has been observed to diminish neural activity."

In other words, achieving a healthy pH balance is a worthy life objective for those who want optimal health.

Keep in mind junk food and junk thoughts should be withheld from the neurons. High quality nutrients and a higher quality standard of thought will result in happier and more content neurons.
Active neurons are awake

Inactive neurons want to sleep.

You learned in a previous chapter that additional neurons are developed as you learn new information. Do not let your neurons retire. Keep them busy by giving them a purpose. Without a purpose, they want to go to sleep.
You can keep your neurons busy by focusing on a short-term or long-term purpose. A short-term purpose may be to complete a puzzle, do some math, enjoy music, or a thousand other activities valuable to your brain. Is your long-term purpose to help others not as fortunate as yourself?

Each of us has a distinct way in which we can make our life count, but the great thing about fulfilling our purpose by helping others is that it not only keeps our neurons busy, it takes our mind off our own problems.

Physician Pamela Grim, at the Tuomey Regional Medical Center in Sumter, South Carolina, asked her elderly gentleman patient, “How are you doing?”

He responded, “Leave me alone, I’m dead.”

Not knowing how to respond, she used her normal response, “How long has this been going on?”

“Since about 7:30,” he said.

Another worker said that he did not seem suicidal. “Of course not”, said Dr. Grim, “He doesn’t need to be suicidal. He’s already dead.”

That story, reported in the Summer, 2007, issue of Medical Mysteries, published by Discover Magazine, is about a man in deep depression because his wife had died. He had no purpose, and his brain literally wanted to go to sleep. The brain of a person in deep depression is inactive. Death may seem to be the only hope.
After a physical examination, doctors recommended Electroconvulsive therapy (ECT). ECT is controversial. It is not even known what happens except that it may be the last resort for some. Even if it does help, it may not help for long. In the case of this man, after he had received about a week of ECT, Dr. Grim saw him sitting alone in the cafeteria, alert, surveying the room and enjoying a big plate of food.

I am exploring various ways to unlock the brain. Music may be one such pathway, especially beautiful music. Beautiful, positive music with meaning is proving valuable to the mind.

Neurosurgeon Burak Ozgur and his team at the University of California at Irvine Medical Center performed brain surgery on a young boy to remove a cancerous tumor from the posterior fossa. The boy’s resulting loss of speech was puzzling because the cerebellum is associated with equilibrium, not speech.

The boy’s sister brought him a DVD of Shrek. When the song, “I’m a Believer” came on, the boy attempted to sing along with the music. In a few weeks, after much practice, he was able to speak normally again.

Using music for improved learning is quite controversial. Some studies have shown that benefits are short term and not long term, while other studies show music does not help. More research is needed to determine if, and when, and how, music can best be integrated into a learning system to benefit children and adults.
Experiments done some years ago seemed to show that listening to classical music could improve memory! This effect was reported far and wide as "The Mozart Effect." Many tests in using music to stimulate the brain have been flawed. I would like to integrate music into a protocol that I believe will deliver some rather interesting results. With proper funding, I am looking forward to working with hundreds of autistic children in an all-out effort to help them expand their minds and improve their brains.

In another chapter, I will report on a study out of the University of Toronto that describes the first solid evidence that indeed music promotes intellectual development.

The first solid evidence that indeed music can improve brain function.
Music and living cells

Music may help your mind in ways you have never dreamed.

Music plays a major role in unlocking the brain of some savants, as you have learned. Can music unlock latent areas of your brain?
New Research Provides The First Solid Evidence That The Study Of Music Promotes Intellectual Development was reported in Science Daily 8/20/04.

The report stated, “The idea that studying music improves the intellect is not a new one, but at last there is incontrovertible evidence from a study conducted out of the University of Toronto.”

The University study was headed up by Dr. E. Glenn Schellenberg, who was with the Department of Psychology at the University of Toronto at Mississauga at the time of the study.

He examined the effect of extra-curricular activities on the intellectual and social development of six-year-old children. A group of 144 children were recruited through an ad in a local newspaper and assigned randomly to one of four activities: keyboard lessons, voice lessons, drama lessons, or no lessons. Two types of music lessons were offered in order to be able to generalize the results, while the groups receiving drama lessons or no lessons were considered control groups in order to test the effect of music lessons over other art lessons requiring similar skill sets and nothing at all. The activities were provided for one year.

The participating children were given IQ tests before and after the lessons. The results of this study revealed that increases in IQ from pre- to post-test were larger in the music groups than in the two others. Generally these increases occurred across IQ subtests, index scores, and academic achievement. Children in the drama group also exhibited improvements pre- to post-test. However, in the area of adaptive social behavior, there were no changes among children who received music lessons.

This IQ study is published in the August issue of Psychological Science, a journal of the American Psychological Society. You can view a PDF (78k) of the full article.
Psychological Science is ranked among the top ten general psychology journals for impact by the Institute for Scientific Information. The American Psychological Society represents psychologists advocating science-based research in the public's interest.

Note: The IQ study published by Science Daily was adapted from a news release issued by American Psychological Society.

The mind of a mathematician may dwell on space, and the mind of a musician may dwell on time. The mathematician builds his world out of numbers and the musician's world is made of sound, well-timed sound. The language of mathematics freezes ice cold slices of static reality. Great music is a dynamic system of created sounds ever moving us toward a new expectation.

Music can prepare us for new expectations of the mind. Perhaps your neurons know and enjoy that possibility. You may learn that the music closest to your heart may open doors to the mind and that other music may block your reception.

I was about ten years old, in the fourth grade, in a one-room country school house (for all 8 grades), when I viewed a 16mm science film. There on the screen was a microscopic picture of a cell from the human heart beating all by itself. Then another cell next to it came into view beating all by itself to a different timing. Then on the screen I saw as they were moved toward each other until they touched. The moment they touched, both human heart cells synchronized and beat as one.

That indelible thought has clung to my mind for all these years, the beat of the human heart. The sound of music may become the sound of new life. Music may help you more than you ever dreamed.
The serious side of humor stimulates the brain

No study shows that anyone has died from laughter.

Laughter is healthy, and humor is fun and funny. Of course, I am not talking about sick humor. While studies show that no one has died from laughter, we also learned that 97.4% of the statistics are made up on the spot.
Studies show that problem-solving abilities improve when laughter precedes the test. Humor relieves stress activity in the cerebral cortex by turning off posterior hypothalmic function.

Good humor, able to make a person laugh for ten minutes, has been known to help a person in pain to sleep for a couple of hours when that otherwise would have not been possible without medication. Norman Cousins, known as the founder of psychoneuroimmunology (PNI), refers to laughter as “internal jogging”. He says that laughter appears to be an especially important ingredient in recovering from life-threatening illnesses.

Professor Lee S. Berk at the Schools of Medicine and Public Health at Loma Linda University in California said in the American Psychological Association’s Monitor (APA), September, 1997, that laughter results in enhanced respiration, immune cell proliferation, a decrease in cortisol, an increase in endorphins, and an increase in salivary immunoglobulin type A concentrations.

Michelle G. Newman, psychologist at Pennsylvania State University, reported in the same APA Monitor publication that learned humor has marked effects as a method for coping with a situation.

There are many types of humor, and we do not have time here to make this a lesson on the types of humor. I will say there is positive (good) humor, and then there is negative (rather sick) “humor.” There is the type of “humor” that cuts and hurts others, and there is the kind of humor that lifts your spirits. Humor is normally a distortion or an exaggeration to make a point. Jesus used this kind of humor when he told his students, “Get the plank out of your own eye before trying to get the speck out of someone else’s eye.”
A good sense of humor can contribute to a long life as evidenced by my grandfather. Frank Burney, my mother’s father, had a wonderful sense of humor that kept him feeling young. He got married for the second time at the age of 86 and lived to be 94. He told me about playing baseball as a kid in eastern Oklahoma with Will Rogers. Now, Will Rogers had a sense of humor that not only was really funny, but taught valuable lessons in the process. He made fun of politicians, and the public loved him for it.

Someone made a bet with Will Rogers that he could not make President Calvin Coolidge, who was very serious, laugh. The moment of the first hand-shake, Will Rogers leaned over and whispered in the President’s ear, “What was that name again?” Will won his bet.

Will Rogers said that old age is when you stop lying about your age and start bragging about it. He said that a long time ago when men cursed and beat the ground with sticks, it was called witchcraft, and today it’s called golf. He taught us that if you do not learn to laugh at your troubles, when you get old, you won’t have anything to laugh about.

Will Rogers, the “scientist,” studied people and learned what made them laugh. Will liked people and said, “I never met a man I didn’t like.” That is the quote for which he is famous, but what most people do not know is that he added the phrase, “If I thought I would not like him, I’d never meet him.” He concluded that people’s laughter will, “keep their minds and bodies in good running order.”

William Fry, who was a psychiatrist from Stanford University, claimed that laughing one hundred times a day will tone you up as much as if you had spent fifteen minutes pedaling a stationary bike. “The stimulation of laughter increases (y)our circulation, because of its effect on the heart and blood pressure,” he said in a published study.
Relax and read or listen to something funny every day. Share the humor. Make other people laugh if they want to or not. When someone responded to me in anger after I told them to have a good day, “I don’t want somebody telling me to have a good day,” I thought that was funny.

“Laughter is very powerful medicine. It can lower stress, dissolve anger and unite families in their resolve to overcome troubled times.” - University of Nebraska.

Science papers indicate the importance of humor to the immune system. The National Library of Medicine and the National Institutes of Health published a paper entitled, *A chuckle a Day Keeps the Doctor Away: therapeutic humor and laughter*. That paper caused me to laughed twice. First when it talked about the placebo effects of humor and secondly when it was suggested that a double blind placebo study was needed. How will they do that, have one comedian that is not funny?

Will Rogers said that old age is when you stop lying about your age and start bragging about it.
"A sense of humor can help you overlook the unattractive, tolerate the unpleasant, cope with the unexpected, and smile through the unbearable."
- Moshe Waldoks, Rabbi and Humorist

"I live by this credo: Have a little laugh at life and look around you for happiness instead of sadness. Laughter has always brought me out of unhappy situations. Even in your darkest moment, you usually can find something to laugh about if you try hard enough."
Red Skelton 1913-1997, Comedian

"Expecting the world to treat you fairly because you are a good person is a little like expecting the bull not to attack you because you are a vegetarian."
- Dennis Wholey

"So live that you wouldn't be ashamed to sell the family parrot to the town gossip."
- Will Rogers

"Don't go around saying the world owes you a living; the world owes you nothing; it was here first."
- Mark Twain

"Smile. It will make you feel better and it will irritate your enemies."
- Kent Krive

“If you keep saying things are getting better, you have the opportunity of becoming a profit center."
- Chad Eschweiler

"Remember when you see a man at the top of a mountain, he didn't fall there."
- author unknown
"Any fool can criticize, condemn, and complain - and most do."
- Dale Carnegie

"Preach the good news as often as you can, and if absolutely necessary, use words."
- St. Francis of Assisi

"100% of the shots you don't take don't go in."
- Wayne Gretzky

"The space for what you want is already filled with what you settled for instead."
- Richard Bach

“When I was young, I was put in a school for retarded kids for two years before they realized I actually had a hearing loss. And they called ME slow!”
- Kathy Buckley

**Here is another mind game:** This is an IQ test. We fill up a bathtub, then give you a teaspoon, a teacup, and a bucket. What do you use? Your answer please?

Answer in the Glossary under IQ Answers.
Age well

He who finishes last, finishes well.

Because you have wanted to expand your mind and improve your brain, you can discover hidden abilities that you have for improving the mental structure of your brain that may contribute to your better overall health for years to come.
Autopsies (of people who finished before you) are revealing new knowledge about the brain, especially in the area of Alzheimer’s. The fact is that more cognitive minds have more synapses per neuron. It is the number of properly-working synapses that give weight, density, literal gray matter and mental capacity to the brain. Protein plaque build up in the synapses is one of the major causes for dementia.

Albert Einstein’s brain was preserved so researchers could study him for a long time. They have been doing just that and have determined that he had more neurons than the average brain. His brain was more active, so his synapses grew. The brain of an Alzheimer’s patient actually shrinks about 10%.

It was discovered that people over ninety years of age with excellent mental capacities have higher levels of the chemical acetylcholinesterase (AChE) in their brains. Researcher Marsel Mesulam (and a team), when at Harvard (before going to Northwestern University) identified the enzyme called acetylcholinesterase.

This discovery is very significant in the field of cognitive science, and you may soon see what is keeping neurotransmitters from working properly. Neurotransmitters have two types of effects, depolarization or hyper-polarization. The post-synaptic ions determine the effects of some transmitters. There are four transmitter sub-stances: acetylcholine, monoamines, amino acids, and peptides.
AChE is an enzyme that works with Acetylcholine (ACh). ACh is released at the synapses and seems to have a post-synaptic effect upon receptors it stimulates. Acetylcholine is involved with learning and recall, as well as in controlling the stage of sleep during which dreams occur. In order to maintain high levels of acetylcholinesterase in your brain, it is imperative to prevent as many toxins as possible from entering your body.

Neurotoxicity in the brain is literally caused by toxins that have made it past the blood brain barrier (BBB). Other toxins can be manufactured in the brain because communication problems with neurons. These neurotoxins wreak havoc with the production of the enzyme acetylcholinesterase, as explained in a paper by J Rank, K K Lehtonen, J Stand, and M Laursen published in June, 2007, by the Roskilde University of Roskile, Denmark, entitled DNA damage, acetylcholinesterase activity and lysosomal stability in native and transplanted mussels (Mytilus edulis) in areas close to coastal chemical dumping sites in Denmark.

Those who take care of their 100-billion-plus neurons are smart people. You may know how to clean a sparkplug with a wire brush, but cleaning the synapses of the neurons is a little different. If you have 100 billion neurons, and each has a few hundred to perhaps 10,000 contact points, you’ve got a lot of cleaning of synapses to do.

Tonie E. Chrapko, author of Secrets of the Brain: The Mystery of Memory, reported that a research team of scientists from both the University of Texas Medical School at Houston and the University of Houston, discovered a new protein – transforming growth factor-B (TGF-B) that acts to solidify the new synapses (Science, March, 1997). However, if there is too much protein, it can build up and “clog” the synapse, thus reducing memory recall.
Usually the neurotransmitter **calpain**, found in calcium, keeps the buildup of protein down. So, inadequate dietary calcium means that too much protein can build up because there is not enough calpain to keep the synapses clean. Unfortunately, an excess of calcium in the diet also creates a problem because the calpain starts to interfere with proper neural transmissions.

A drastic way to remove excess protein from the synapse is by electric shock. **Acetylcholine**, one type of neurotransmitter, is important for three reasons: it is necessary for activating REM (rapid eye movement) sleep, it keeps neural membranes intact so that they don't become brittle and fall away, and it breaks down the excess build-up of amyloid protein at the synapses found in Alzheimer's patients (Robert Wurtham, director of the Clinical Research Center at Massachusetts Institute of Technology).

**So, what can you do about it?:**

Here is a little check list for you to follow.

- Stay mentally active and keep the neurons firing.
- Don’t worry about anything. Be happy.
- Eat more super foods, more brain foods.
- Eat and drink high pH foods and drinks.
- Drink lots of clean water,
- preferably oxygenated and high pH water.
- Exercise and
- breathe deeply to get more oxygen to the brain and the rest of the body.

- Make new friends, or
- at least work on keeping the ones you have that have a positive impact on your life.

- Do something good for them.

- Listen to good music.

- Make positive affirmation everyday that you believe are truthful.

- Read and listen to good humor every day.

- Read Scripture and other meaningful, positive writings.

- Do not let negative people put negative thoughts in your head.

- Be happy. It is worth repeating.

- Be filled with joy which can be your strength.
Choose to have a great day whether you feel like it or not.

Add your own objectives to this list.

Aging, in the game of life, is the game where you do everything you can to finish last. He and she who finish last can finish last when finishing well.
Reversing brain damage
We now know you can build new brain cells.

A few years ago, the thought of brain repair without surgery was off the chart and out of the box. Of course, that is where I have lived most of my life. What box?
Scientists used to believe that when brain cells died, that was it, it was over. Now, we know that even thought generates new synapses and that the neurons can be re-populated. That is good news, especially for those who have killed off so many brain cells with drugs, alcohol, smoking and negative thinking.

There are many stories today about brain injuries and strokes that were considered “impossible” cases, that have today been reversed. One of the most remarkable reports of reversing brain damage is actually about a medical doctor who is a good friend of mine and has stayed in our home. Before his brain damage, he was Chief of Staff at the Royal Alexandra Hospital in Edmonton, Alberta Canada. He was a case study at the First and Second Glycomics Medical Conference held in The Woodlands, Texas, just north of Houston. He had been told that one third of his brain had been destroyed. However, his last physical revealed that it was all functioning very well.

Here is the story of Alex Omelchuk, MD, in his own words:

_I once worked 80 hours a week - plus on call time (nights, weekends, and holidays). I saw upwards of 30 patients per day in my main office, plus I did hospital rounds, hospital emergency work, nursing homes and care facility visits, obstetrics as well as hospital administrative duties, and I was one of the few doctors who made house calls on a regular basis. (Yes, I have a very understanding wife!) My wife and I also ran a satellite office - evenings, weekends and emergencies._

_I exercised regularly - racquet-ball, ran my dog, and squeezed in as many “mini holidays” as I could, often combining business and pleasure trips. I took time for myself. So, it was with great surprise and shock that I found myself cut down_
by a massive cerebellar aneurysm. I was perfectly healthy by all outward appearances, and didn’t feel tired. In fact, I was invigorated by work, and my desire to help people was strong.

However, I forgot the Cardinal Rule: Just because you have no symptoms, it doesn’t mean you are perfectly healthy.

On Nov. 5, 1987, at 10:44 p.m., I was perfectly fine. At 10:45 p.m., literally one minute later, I was virtually dead. I suffered a ruptured aneurysm of the right middle cerebellar artery with a massive intracranial bleed. Literally, my head “exploded” with unbelievable pain, and I was on the verge of death. Before I passed out, I was able to tell my wife what was happening and what she could expect to happen next. Orissa called an ambulance and got me to my hospital ASAP.

In the Hospital, Orissa said because I was Chief of Staff, it was like a scene from ER. All of the best surgical, emergency and medical specialists (doctors and nurses) were awaiting my arrival in the ambulance bay. I received immediate critical care. I was extremely lucky to have survived.

Physicians and nurses in the US and Canada do an excellent job in acute and trauma care. They are the best in the world and I owe my life to their expertise.
As soon as I was stabilized (approximately twenty-four hours later), I underwent nine hours of delicate brain surgery to repair the aneurysm and restore the blood circulation to my brain. I was comatose and on life support in the ICU for a number of days.

Things did not look good for my ultimate survival. In fact, I found out later that the bulletin board in the doctors’ lounge posted an update of my condition, which read “In coma. Near death. Not expected to survive.”

I eventually woke up but was totally incapacitated. I could not walk, talk, or feed myself, or function in any other capacity. I underwent all types of rehabilitation therapies: speech, occupational, physio-, and psycho-therapy.

This continued in the hospital for months, and I maintained self-therapy at home for years. Eventually I was functional and gradually improved over the years. But after twelve years, I was still considered totally disabled. I was told to “get used to it because you’ve recovered as much as you ever will.”

My most persistent disabilities were: (1) severe impairment of short term memory and cognitive ability with severe fatigue. I could only function for about two hours between naps. My day pretty well went something like this: Get up, eat breakfast, have a nap, eat lunch, have a nap, eat dinner, have nap and then go to bed. (2) balance problems. I couldn’t feel my feet from the knees down and
subsequently fell down a lot. (3) I had persistent, unrelenting head pain which is a significant complication of brain injury. I would wake up in the middle of the night moaning and crying in pain. (4) I had to take all types of pain medications including Demerol, Toradol, 292, Tylenol 3, Fiorinal, Fiorinal -C.

My wife would sit up, to make sure I was still breathing because I took so many pain killers, I was in danger of overdosing. She was always afraid that when I took a shower that I would fall and injure myself, and that she wouldn’t be able to pick me up again.

I lived with pain and fatigue for twelve years, every day, all day, and all night. I was alive, but I had no quality of life. I tried to volunteer, just to keep active and feel useful. I was becoming extremely depressed with my lot. I am a doctor, and I couldn’t fix myself.

In the spring of 2000, I was introduced to the science of glycomics. At first, because I am a doctor, I was extremely skeptical of Glyconutritionals and how they are able to help your body heal itself.

I spent hours at the computer, researching the science about glycoprotein technology. I was surprised at the number of science papers.
Within weeks (after taking glyconutrients) I started to notice improvements in my energy levels, short-term memory, cognition, and I began to feel fantastic. I no longer had to nap, I could feel my legs from the knees down, and I didn’t fall anymore. In about four months, I was totally pain free. I have not had to take any tranquilizers, pain pills or anti-depressants since July, 2000.

All aspects of my life have improved. I can function effectively all day without resting. I teach Anatomy and Physiology to students at a private college. I give public lectures on the science and benefits of glycomics. I have my life back.

Dr. Alex Omelchuk
Placebos:

Brain power at work

Sometimes placebos may work better than drugs.

Placebos are sugar pills used in double-blind studies with half of the patients getting the drug and the other half getting the sugar pills.
Mark Ardis, a retired Veterans Administration psychiatrist, psychiatric administrator, and university professor, says that if the patient even suspects that the physician is using placebos, the trust relationship between them is likely to deteriorate.

If people believe it is a 50/50 chance they are getting a placebo instead of the drug, they may have just lost faith in the both “drug” and the doctor, even if it is the actual drug they are taking. Concerning placebos, some have gone as far as to say, “If it is a life and death situation and the medication could save the life, it is criminal to withhold something from the patient that might save his or her life.”

Research verifies that the placebo effect causes a remission of many types of illnesses and has the ability to cause the body to heal itself from "incurable" diseases. Jokingly I once said that a sugar pill had caused spontaneous remission, only to learn later that it was no joke.

One study had positive results in 40% of the depressed patients as a result of taking a placebo. If it looks like a pill and you are told that it is a pill, perhaps it will act like a pill. Your body may respond to its own anticipation. I think that is called faith. “It is part of the cure to wish to be cured.” is a quote from Lucius Annaeus Seneca (often known as Seneca) (4 BC-AD 65).

Walter Brown, author of “The Placebo Effect,” is a psychiatrist at the Brown University School of Medicine. He believes that physicians should consider prescribing placebos in place of drugs because of cost and lack of side effects. If that does not work, then try medication.

**Placebos prove the power of the mind.**
The brain has within it the power to control the cells and produce virtually any chemical known to man upon cue.

A remarkable account of the placebo effect is that of Dr. Bruno Klopfer and Mr. Wright, a cancer patient who had only a few weeks to live. Dr. Klopfer treated Mr. Wright with an experimental cancer drug called Krebiozen. Shortly after being injected with the drug, the patient's tumor masses "melted like snowballs on a hot stove." A few months later when the newspapers published the results that the drug was worthless, Mr. Wright's tumors appeared again.

Wanting to be well, wanting to be cured, wanting to become better is at the core of cognitive science. We need to learn to better use our brains. That is what this series is all about.

Herbert Benson at Mind/Body Clinic of New England Deaconess Hospital in Boston reports that 80% of hypertension patients are able to either reduce their blood pressure or their drug dosage with a relaxation technique.
Gregg Jacobs, psychologist at Harvard University’s Mind/Body Medical Institute, reports that it only takes five minutes of Benson’s relaxation technique to detect dramatic brain wave changes.

Your emotional state is perhaps the greatest threat to your immune system. Franz Ingelfinger, past editor of the New England Journal of Medicine, in his last article (1980) stated that he believes that 85% of all human illnesses can be addressed with the immune system.

When you do not have a strong modulated immune system, you have poor health and lack of proper nutrients getting to the brain. Also, a poor immune system cannot stand at the door to keep more toxins from storming your castle. To protect the brain, more guards are needed at the Blood Brain Barrier (BBB).

A good healthy laugh may be some of the best medicine you can receive.
Your emotional state is perhaps the greatest threat to your immune system. Franz Ingelfinger, past editor of the *New England Journal of Medicine*, in his last article (1980) stated that he believes that 85% of all human illnesses can be addressed with the immune system.
Alcohol destroys brain cells in parents and their children may pay the price with fewer brain cells.
Fetal Alcohol Syndrome (FAS)

Embryo, fetal development, and what may be changed after the fact.

The windows of opportunity for the baby are smashed by the expectant mother when she abuses her body and brain with alcohol, drugs, or smoke.
The tiny brain forming in the fetus is becoming a living incubator for thought and will replicate many of the characteristics of the parents. Healthy development of the baby is dependent upon the health of the mother. The strengths of the mother are going into the baby. The mother’s brain is busy every moment during pregnancy working out the details for the child’s future. The mother’s brain actually shrinks some 3% to 5% during those nine months. So says Anita Holdcroft, an anesthetist with the research team at London’s Royal Postgraduate Medical School, and reported in the *Montreal Gazette* in 1997. Within six months after delivery, the mother’s brain has returned to normal size.

David Earnest led a Texas A&M University team that discovered in a rat study that high use of alcohol during pregnancy RESULTED IN SYMPTOMS OF ADVANCED AGING and various brain dysfunctions.

FAS is associated with a plethora of problems throughout life. 90% of the babies born with FAS have mental health problems. 60% have trouble with law enforcement agencies. 50% are involuntarily imprisoned. And, a big problem, 50% are accused of inappropriate sexual behavior.

**Alcohol causes advanced aging and brain dysfunctions.**

**90% FAS babies have mental problems.**
**60% have trouble with the law.**
**50% are imprisoned.**
**50% display inappropriate sexual behavior.**

**This is a national concern and the reason research with an answer is needed now.**
This is a national concern and the reason research with an answer is needed now. This is not an isolated laboratory study. This is life and death future of our children.

Cocaine use during fetal development lowers birth weight, the baby has withdrawal and a smaller head size along with other consequences. Marijuana and prescription drugs also have major damaging effects on the embryo.

Good health of the mother is important prior to the nine-month pregnancy, but during the nine months, the health of the mother IS CRITICAL. This is the time for the parents to provide an optimal health environment for the child. How precious is a new life? Studies show that beautiful music played for the baby is beneficial. Mellow music actually enhances the immune system. So says Carol Charnetski, chair of the Psychology Department at Wilkes University in Wilkes-Barre, Pennsylvania.

I reported earlier that H. Reg McDaniel, MD discovered that certain micro-nutrients may stimulate the proliferation of functional neurons in FAS.

He presented his work with FAS children at the first and second Glycomics Medical Conference. These children were diagnosed with FAS and the families told that they would never be able to function normally.

This FAS report is available in a syllabus on CD and a DVD of Dr. McDaniel presenting his findings before a congressional group. After eight years, he reports that the children, while not completely “normal,” are enjoying life, riding bikes, playing on the trampoline, and going to school. The apparent brain-function improve-ment was due to the micro-nutrients the children received similar to those found in human mother’s breast milk.*
Alcohol has become a larger problem in the United States because a person under the influence often is treated as the “life of the party,” while in many other countries the drunk is shamed, belittled, and put in his or her place. The demographics are changing. Pierce J. Howard, PhD in his book “The Owner’s Manual for the Brain” says that the elderly have shown an increase of over 50% in alcoholism (which inspires young mothers-to-be to drink more).

Today more seniors are hospitalized with alcohol problems than heart disease. Of hospitalized seniors over 60 years of age, about 25% are diagnosed as alcoholics. About 25% of Medicare costs go to treating alcohol abuse and it’s growing.

Alcoholism affects not only the newborn in FAS, but compounds the health of seniors and escalates the cost of healthcare by literally many billions of dollars.

The good news is that help is available for those who want it.

* The CD and DVD are available for a contribution of $50 that goes to the Fisher Institute for Medical Research and The Endowment for Medical Research. www.EndowmentMed.org. Also available is Dr. McDaniel’s presentation at the Glycomics Medical Conference as part of a 14 hour Continuing Medical Education Credit course available on DVD. This is available for CME or CEU credits for $299 and includes a 580 page syllabus on CD. The general public can also receive this 14 hours of education for $199 without the syllabus by ordering online at www.EndowmentMed.org. The funds go to the non-profit medical and education organization.
Alcoholics deny that they have a problem.
Put all sugars and sweeteners into three classes:

- Bad sugars
- Good sugars
- Super sugar
Sugar on your brain

Harmful sugars • Good sugars • Super Sugars

An outstanding authority on the dangers of sugar is Nancy Appleton, PhD, and author of a number of books including *Lick The Sugar Habit*. Dr. Appleton is one of the leading crusaders about how sugar can damage your health.
In addition to throwing off the body's homeostasis, excess sugar may result in a number of other significant consequences. Dr. Appleton, in a Gatlin-gun approach, lists some of sugar's metabolic consequences from a large number of medical journals and other scientific publications which are carefully referenced at the end of the book. All sugars are not bad, some are good; and indeed, there are super sugars as I will discuss.

In April 1998, I wrote a paper *Good Sugars vs. Bad Sugars*. Quote from paper: “Bad sugars may contribute to heart disease, cancer, stroke, bronchitis, osteoarthritis, rheumatoid arthritis, ADD, ADHD, chronic fatigue, and fibromyalgia. 

*The following statements are supported by over 200 references from publications and published papers. See pages 315-336 for the supporting evidence.*

**Harmful sugars:**

(1) Sugar can **suppress the immune system**.

(2) Sugar **upsets the mineral relationships** in the body.

(3) Sugar can cause **hyperactivity, anxiety**, difficulty concentrating, and **crankiness** in children.

(4) Sugar can produce a significant **rise in triglycerides**.

(5) Sugar contributes to the reduction in defense against bacterial infection (**infectious diseases**).

(6) Sugar causes a **loss of tissue elasticity and function**, the more sugar you eat the more elasticity and function you loose.

(7) Sugar reduces high density **lipoproteins**.

(8) Sugar leads to **chromium deficiency**.
(9) Sugar leads to cancer of the ovaries.

(10) Sugar can increase fasting levels of glucose.

(11) Sugar causes copper deficiency.

(12) Sugar interferes with absorption of calcium and magnesium.

(13) Sugar can weaken eyesight.

(14) Sugar raises the level of a neurotransmitters: dopamine, serotonin, and norepinephrine.

(15) Sugar can cause hypoglycemia.

(16) Sugar can produce an acidic digestive tract.

(17) Sugar can cause a rapid rise of adrenaline levels in children.

(18) Sugar malabsorption is frequent in patients with functional bowel disease.

(19) Sugar can cause premature aging.

(20) Sugar can lead to alcoholism.

(21) Sugar can cause tooth decay.

(22) Sugar contributes to obesity.

(23) Sugar intake levels that are high increases the risk of Crohn's disease, & ulcerative colitis.

(24) Sugar can cause changes frequently found in persons with gastric or duodenal ulcers.
(25) Sugar can cause arthritis.
(26) Sugar can cause or be factor with asthma.
(27) Sugar greatly assists the uncontrolled growth of Candida Albicans (yeast infections).
(28) Sugar can cause gallstones.
(29) Sugar can cause heart disease.
(30) Sugar can cause appendicitis.
(31) Sugar can cause multiple sclerosis.
(32) Sugar can cause hemorrhoids.
(33) Sugar can cause varicose veins.
(34) Sugar can elevate glucose and insulin responses in oral contraceptive users.
(35) Sugar can lead to periodontal disease.
(36) Sugar can contribute to osteoporosis.
(37) Sugar contributes to saliva acidity.
(38) Sugar can cause a decrease in insulin sensitivity.
(39) Sugar can lower the amount of Vitamin E (alpha-Tocopherol) in the blood.
(40) Sugar can decrease growth hormone.
(41) Sugar can increase cholesterol.

(42) Sugar can increase the systolic blood pressure.

(43) Sugar can cause drowsiness and decreased activity in children.

(44) High sugar intake increases advanced glycation end products (AGEs) (Sugar bound non-enzymatically to protein)

(45) Sugar can interfere with the absorption of protein.

(46) Sugar causes food allergies.

(47) Sugar can contribute to diabetes.

(48) Sugar can cause toxemia during pregnancy.

(49) Sugar can contribute to eczema in children.

(50) Sugar can cause cardiovascular disease.

(51) Sugar can impair the structure of DNA (alter gene expression)

(52) Sugar can change the structure of protein.

(53) Sugar can make our skin age by changing the structure of collagen.

(54) Sugar can cause cataracts.

(55) Sugar can cause emphysema.

(56) Sugar can cause atherosclerosis.
(57) Sugar can promote an elevation of low density lipoproteins (LDL).

(58) High sugar intake can impair the physiological homeostasis of many systems in the body.

(59) Sugar lowers the enzymes ability to function.

(60) Sugar intake is higher in people with Parkinson’s disease.

(61) Sugar can cause a permanent alteration in the way the proteins act in the body.

(62) Sugar can increase the size of the liver by making the liver cells divide.

(63) Sugar can increase the amount of liver fat.

(64) Sugar can increase kidney size and produce pathological changes in the kidney.

(65) Sugar can damage the pancreas.

(66) Sugar can increase the body's fluid retention.

(67) Sugar is enemy #1 of the bowel movement.

(68) Sugar can cause myopia (nearsightedness).

(69) Sugar can compromise the lining of the capillaries.

(70) Sugar can make the tendons more brittle.

(71) Sugar can cause headaches, including migraine.

(72) Sugar plays a role in pancreatic cancer in women.
Sugar on your brain  Chapter 36

(73) Sugar can adversely affect school children's grades and cause learning disorders.

(74) Sugar can cause an increase in delta, alpha, and theta brain waves.

(75) Sugar can cause depression.

(76) Sugar increases the risk of gastric cancer.

(77) Sugar and cause dyspepsia (indigestion).

(78) Sugar can increase your risk of getting gout.

(79) Sugar can increase the levels of glucose in an oral glucose tolerance test over the ingestion of complex carbohydrates.

(80) Sugar can increase the insulin responses in humans consuming high-sugar diets compared to low sugar diets.

(81) High refined sugar diet reduces learning capacity.

(82) Sugar can cause less effective functioning of two blood proteins, albumin, and lipoproteins, which may reduce the body’s ability to handle fat and cholesterol.

(83) Sugar can contribute to Alzheimer’s disease.

(84) Sugar can cause platelet adhesiveness.

(85) Sugar can cause hormonal imbalance; some hormones become underactive and others become overactive.

(86) Sugar can lead to the formation of kidney stones.
Sugar can lead to the hypothalamus to become highly sensitive to a large variety of stimuli.

Sugar can lead to dizziness.

Diets high in sugar can cause free radicals and oxidative stress.

High sucrose diets of subjects with peripheral vascular disease significantly increase platelet adhesion.

High sugar diet can lead to biliary tract cancer.

Sugar feeds cancer.

High sugar consumption of pregnant adolescents is associated with a two-fold increased risk for delivering a small-for-gestational-age (SGA) infant.

High sugar consumption can lead to substantial decrease in gestation duration among adolescents.

Sugar slows food's travel time through the gastrointestinal tract.

Sugar increases the concentration of bile acids in stools and bacterial enzymes in the colon. This can modify bile to produce cancer-causing compounds and colon cancer.

Sugar increases estradiol (the most potent form of naturally occurring estrogen) in men.

Sugar combines and destroys phosphatase, an enzyme, which makes the process of digestion more difficult.

Sugar can be a risk factor of gallbladder cancer.
(100) Sugar is an **addictive** substance.

(101) Sugar can be **intoxicating**, similar to **alcohol**.

(102) Sugar can **exacerbate PMS**.

(103) Sugar given to premature babies can affect the amount of **carbon dioxide** they produce.

(104) Decrease in sugar intake can increase **emotional stability**.

(105) The body changes sugar into 2 to 5 times more **fat in the bloodstream** than it does starch.

(106) The rapid absorption of sugar **promotes excessive food intake in obese** subjects.

(107) Sugar can worsen the symptoms of children with **attention deficit hyperactivity disorder (ADHD)**.

(108) Sugar adversely affects urinary **electrolyte** composition.

(109) Sugar can slow down the ability of the **adrenal glands to function**.

(110) Sugar has the potential of inducing abnormal metabolic processes in a normal healthy individual and to promote **chronic degenerative diseases**.

(111) I-Vs (intravenous feedings) of sugar water can **cut off oxygen to the brain**.

(112) High sucrose intake could be an important risk factor in **lung cancer**.
(113) Sugar increases the risk of **polio**.

(114) High sugar intake can cause **epileptic seizures**.

(115) Sugar causes **high blood pressure** in obese people.

(116) In Intensive Care Units, **limiting sugar** saves lives.

(117) Sugar may induce **cell death**.

(118) Sugar can increase the amount of food that you eat. (**craving**)

(119) In juvenile rehabilitation camps, when children were put on a low sugar diet, there was a 44% drop in **antisocial behavior**.

(120) Sugar can lead to **prostate cancer**.

(121) Sugar **dehydrates** newborns.

(122) Sugar increases the **estradiol** in young men.

(123) Sugar can cause **low birth weight** babies.

(124) Greater consumption of refined sugar is associated with a worse outcome of **schizophrenia**.

(125) Sugar can raise **homocysteine** levels in the **bloodstream**.

(126) Sweet food items increase the risk of **breast cancer**.

(127) Sugar is a risk factor in **cancer of the small intestine**.
Sugar may cause laryngeal cancer.

Sugar induces salt and water retention.

Sugar may contribute to mild memory loss.

As sugar increases in the diet of 10 year-olds, there is a linear relationship.

Sugar can increase the total amount of food consumed. (craving)

Exposing a newborn to sugar results in a heightened preference for sucrose relative to water at 6 months and 2 years of age. (addiction)

Sugar causes constipation.

Sugar causes varicous veins.

Sugar can cause brain decay in prediabetic and diabetic women.

Sugar can increase the risk of stomach cancer.

Sugar can cause metabolic syndrome.

Sugar ingestion by pregnant women increases neural tube defects in embryos.

The higher the sugar consumption the more chances of getting irritable bowel syndrome (IBS).

Sugar could affect central reward systems.
(142) Sugar can cause cancer of the rectum.
(143) Sugar can cause endometrial cancer.
(144) Sugar can cause renal (kidney) cell carcinoma.
(145) Sugar can cause liver tumors.
(146) The more soft drinks, fruit juice and sugary snacks a person eats, the lower the high density lipoproteins (HDL).
(147) Sugar Consumption can cause Myocardial Infarction

Not enough bad news? New reports indicate that high fructose corn syrup is proving to be worse and is compounding the obesity epidemic.

We should rate the some 200± sugars found in nature according to each sugar’s health benefit(s) or harmfulness.

Good sugars

There are a few good sugars and sweeteners. One of my objectives for my newsletter is to rate the approximately 200 sugars found in nature according to each sugar’s health benefit(s)harmfulness. I plan to also use other ratings with these sugars and sweeteners according to their levels of sweetness, glycemic indexing and what can be expected with possible negative side effects or positive serendipities. Because of the studies that have been conducted on the sugar trehalose, I have chosen that as the healthy sugar that can be used as a sweetener. It is healthy, and it is only about 45% as sweet as table sugar.
Honey has been enjoyed throughout history as a sweetener. Honey is mentioned in the Bible as good but not too much at one time. Honey is high glycemic and raises your glucose level rather quickly. Local honey may be better for you than honey from far away because of possible benefit to allergies. I have not seen any studies on honey and food allergies, but I have three hypotheses:

(1) Eating raw local honey from your area may be better because some of the pollens you have been breathing in the air were used by the bees to manufacture this savoring sweetener. You are already accustomed to these pollens, so they are not as harmful to you;

(2) Eating honey from the area you were born may be good for you because the allergies you have were probably established from your birth and early years. These are the similar pollens that you became used to that laid down your allergy sensitivity;

(3) Foreign honey is made from foreign pollen to which you are not acquainted. The major problem with foreign honey, especially from far away countries, is that the honey may have become polluted (a) by the bees; (b) by the processing; or (c) over time and travel. Allergic reactions generally are 'set up' in your system at birth or during youth, so the pollens from THAT area are the ones that will help to desensitize you.

Honey sold in stores and restaurants throughout the United States is generally blended with honey from a number of different countries. The motivation for sellers to blend honey is mainly economical. It spreads the risk because less may be used from a country with lower quality honey. However, at the same time, blending raises the possibility for more honey to become contaminated.
Super Sugars

I have not devoted much time or space to the Super Sugars in this book, and yet that is what it is all about. Researchers are giving the Super Sugars a serious exploration. Glycomics is all about Super Sugars and more physicians are beginning to incorporate these sugars into their practice while drug companies are rushing to synthesize these sugars into new drugs.

Super Sugars are evidence-based and the results are in the facts. Are there benefits and results, or are these “super sugars” really just worthless “sugar pills”? To my knowledge, there are nine very significant super sugars. Eight of these were presented by Robert K. Murray, MD, PhD, and published in the last six editions of Harper’s Biochemistry. I have added trehalose as the ninth super sugar because of studies and published research papers.

I have had personal experience for about twelve years with the super eight sugars before we added trehalose into the mix. Trehalose, in some cases, seems to make the other sugars have more efficacy. This is called evidence based nutrition.

The reason these are, indeed, Super Sugars, is not only their efficacy individually but the fact that scientists have discovered that they work together. They work together to strengthen the cell and cell membrane so the cell can become proficient with other cells to form your whole neurological communication and motor system.
In short, without these Super Sugars, you would have no quality of life. Some scientists debate that your body can produce all these sugars without ingesting them if you have only glucose in your body to start with. I do not disagree that your body could manufacture the other sugars from just one. It is a fact, however, that while your body could manufacture them, your body does not manufacture enough, because of the time and energy required and the enzymatic gymnastics necessary to make it happen.

Our sources of sweeteners have changed from those of our great grandparents. They ate black strap molasses, maple syrup, and unrefined cane sugar. Years ago these super sugars were in our foods. They ate whole grain cereals and unbleached flours. Today, we are not eating the foods with these sugars or these sugars have been processed out.

Evidence is pointing to the fact that it is the absence of these sugars in our diets today that may very well be one of the major contributors to the decline in health. The compounding diseases started as sweeteners were changed and the green harvest escalated. Trucking fruits and vegetables required they be picked green and that was the birthing of a new debilitating way of life.

Couple the removal of these super sugars from our diets with added toxins in our air, water, and soil makes the problem very serious. These problems brought the United States be all behind thirty six (36) other countries in health.

Evidence is pointing to the fact that it is the absence of these sugars in our diets that may very well be one of the major contributors to the rise in healthcare costs. Instead of replacing what was missing, the symptoms were treated and treated throughout life.

Evidence is pointing to the fact that the rise in healthcare costs is having a major impact on the economy for individuals, families, corporations, and government. Bankruptcies of major concern for all and this concern is fueled by rising healthcare costs.
Evidence is pointing to the fact that putting these sugars back into our diets could very well save lives for a fraction of the spiraling out of control cost of drug treatments for the symptoms.

The nine Super Sugars needed to build the communication system and the strength of your cells are: fucose, galactose, glucose, mannose, n-acetylgalactosamine, n-acetylglicosamine, n-acetyleneuraminic acid, xylose, and trehalose.

- fucose,
- galactose,
- glucose,
- mannose,
- n-acetylgalactosamine,
- n-acetylglicosamine,
- n-acetyleneuraminic acid,
- xylose, and
- trehalose.

The public is becoming more aware that vitamins and minerals and certain foods are indeed greatly beneficial in preventing or even curing certain ailments. But, the FDA owns the words “treat” and “cure” and must give their approval for their use.

We all know that a bottle of water treats dehydration, but the FDA will not allow you to say that. You cannot sell a box of salt with iodine in it and claim that it treats thyroid. You cannot put a label on a lemon and say it treats scurvy, but tests prove that it does.

It is the duty of the FDA to protect the American populous from bogus products that do not work. I applaud them for the good work they do. But, like all humans, they make mistakes and approve drugs that kill people and do not allow label claims on some food supplements that are safe and have proven efficacy. In the drug paradigm a double blind placebo clinical trial is necessary and there must be an established LD$_{50}$ level. That is a lethal dose to kill fifty percent (50%) of the subjects in the study.
The FDA requires this barbaric LD$_{50}$ test on healthy animals. Usually mice or rats are used but sometimes dogs, monkeys or other animals are force fed enough poison to kill (usually slowly) approximately 50% of them.

I have no problem in using animals in studies in an attempt to save the lives of humans. However, it is my conclusion that the LD$_{50}$ means of testing is not only unethical because it is animal cruelty but that it is also an inaccurate crude test and therefore unnecessary. It is based on the premise that all drugs are poison as a criteria for it being a drug.

It is difficult to kill anything with sugar unless you mix it with a toxic drug. Which is exactly what is happening.

Remember, these sugars are used to help construct the glycoproteins on the surface of every cell in your body.

The National Library of Medicine cites over 434,000 (yes, that is four hundred thirty four thousand) references to published papers on glycoprotein technology. Scientists are adding so many new research papers each day (thousands per month) that no one can keep up with the progress of this science.

Let us look a little closer at each of the sugars.

- **fucose:** (not to be confused with fructose) Studies show humans depend on fucose, has health benefits, may prevent and treat cancer, and the National Library of Medicine cites over eight thousand (8,000) references with over one thousand (1,000) linked to cancer.

- **galactose:** Studies show that galactose has health benefits, humans are dependant upon it, and over twenty seven thousand (27,000) references are cited by the National Library of Medicine linked to research.
• **glucose:** The medical establishment recognizes the basic sugar glucose as very important to life. However, it appears to be the most harmful in large quantities, especially for diabetics. Glucose is used in solution to treat nearly everyone in nearly every hospital.

• **mannose:** Studies show that mannose has health benefits, especially cancer, humans are dependant upon it, and is cited by the National Library of Medicine for over twenty thousand (20,000) references linked to research.

Mannose was approved by the USDA for treatment of cancer in animals. Mannose is used in the vaccination of baby chicks and CANCER HAS BEEN ERADICATED FROM THE POULTRY INDUSTRY.

A number of years ago, cancer was a major problem in the poultry industry. I personally knew an inspector of chickens at a chicken processing house. He and I had become friends and he confided in me that his eyesight was getting poor and he was concerned that he was allowing contaminated meat to reach the public. When he consulted in me as to my advice of what he should do, without hesitation, I told him he should resign immediately. I knew that inspecting chickens was his life and family’s likelihood, but the lives of innocent people were at risk. I am saying all of this to state that mannose was made into a drug approved by the USDA (United States Department of Agriculture) for treating and preventing cancer in animals. Mannose has worked so well, that every baby chicken in the entire poultry industry is now vaccinated with a drug containing mannose and CANCER HAS BEEN ERADICATED FROM THE POULTRY INDUSTRY. You do not hear of any concern of cancer in chickens anymore because of mannose.
• **n-acetylgalactosamine:** Studies show that n-acetylgalactosamine has health benefits, humans are dependant upon it, used in cancer research, and cited by the National Library of Medicine for about three thousand (3,000) references linked to research.

• **n-acetylglucosamine:** Studies show that n-acetylglucosamine has health benefits, used in cancer research, and cited by the National Library of Medicine for about three thousand (3,000) references linked to research.

• **n-acetylneuraminic acid:** Studies show that n-acetylneuraminic has health benefits, humans depend upon it, used in cancer research, and cited by the National Library of Medicine for over five thousand (5,000) references linked to research.

• **xylose:** Studies show health benefits, used in cancer research, and cited by the National Library of Medicine for over seven thousand five hundred (7,500) references linked to research.

• **trehalose:** Studies show health benefits, used in cancer research, and cited by the National Library of Medicine for about three thousand seven hundred (3,700) references linked to research.

Should you still doubt the enormous health benefits available through these nine sugars, take a look at the number of patents using of these sugars that have already been issued.

The U. S. Patent Office has issued an astounding number of patents on the use of these nine sugars. When you take the number of patents on each sugar and add them together you get (as of this writing), 153,613 patents. About 103,000 of these patents were issued since 1995.

There is a desperate frenzy to synthesize these sugars into drugs. Drugs are made by man. Sugars are found in nature. One of the claims when using these sugars with drugs is that it lessens the side effects. They come up with a better LD$_{50}$ test.
You and your children will be hearing more about glycomics as the drama unfolds and as the people demand evidence based healthcare.

### Patents Issued by the U.S. Patent Office for use of the nine sugars

<table>
<thead>
<tr>
<th>Sugar:</th>
<th>since 1995</th>
<th>Total Patents</th>
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<tbody>
<tr>
<td>Mannose</td>
<td>10,698</td>
<td>15,552</td>
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<tr>
<td>Galactose</td>
<td>13,128</td>
<td>19,597</td>
</tr>
<tr>
<td>Xylose</td>
<td>6,003</td>
<td>10,161</td>
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<tr>
<td>Glucose</td>
<td>62,096</td>
<td>95,293</td>
</tr>
<tr>
<td>n-acetylglucosamine</td>
<td>1,782</td>
<td>2,322</td>
</tr>
<tr>
<td>n-acetylgalactosamine</td>
<td>789</td>
<td>981</td>
</tr>
<tr>
<td>n-acetylneuraminic acid</td>
<td>519</td>
<td>711</td>
</tr>
<tr>
<td>Fucose</td>
<td>2,111</td>
<td>2,826</td>
</tr>
<tr>
<td>Trehalose</td>
<td>?</td>
<td>6,170</td>
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<td>153,613</td>
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Source: U.S. Patent Office
A major cause for Obesity

It’s Your Health, It’s Your Life

An overweight America is up to its waistline in high fructose corn syrup (HFCS). We gulp down corn syrup each day like it is coming to us through a fire hose. Check the labels. It may be in nearly everything you eat and drink. Your soft drinks are saturated with high fructose corn syrup.
Nutritionists are pointing the finger at HFCS as the major cause of obesity. While researchers still debate the causes for diabetes, most agree that obesity is a major contributor. The flood of corn syrup rose across the land in the early 1980s around the same time scales started breaking from overweight. I remember seeing a cartoon of a talking scale. It said, “One of you please get off.”

New evidence from Rutgers University suggests that sodas sweetened with HFCS may increase the risk of diabetes and obesity, particularly in children. In August 2007, a report was presented at the American Chemical Society symposium by Chi-Tang Ho, PhD. Dr. Ho is professor of food science at Rutgers University in New Brunswick, N.J., where he conducted chemical tests among eleven different carbonated soft drinks containing HFCS.

He found “astonishingly-high” levels of reactive carbonyls in those beverages. The result is "unbound" fructose and glucose molecules which are believed to trigger cells to do tissue damage causing disease at epidemic levels. Reactive carbonyls are not even found in “bad-for-you table sugar” where fructose and glucose components are "bound" and chemically stable, researcher Ho stated in his report.

Reactive carbonyls are especially elevated in the blood of diabetics and cause complications in diabetics. Based on the study data, Ho estimates that a single can of soda contains about five times the concentration of reactive carbonyls than the concentration found in the blood of an adult person with diabetes.
A major cause for obesity

Chapter 37

Ho’s group is also probing the mechanisms by which carbonation increases the amount of reactive carbonyls formed in sodas containing HFCS. They note that non-carbonated fruit juices containing HFCS have one-third the amount of reactive carbonyl species found in carbonated sodas with HFCS.

Your body processes HFCS differently than it does the other “bad sugars” made from cane or beets. High fructose alters the way metabolic-regulating hormones function and causes the liver to throw more fat into the bloodstream.

Dietian Katherine Zeratsky, RD, LD, at Mayo Clinic, says that animal studies have shown a link between increased consumption of HFCS and adverse health effects, such as diabetes and high cholesterol.

Carol Porter, director of nutrition and food services at University of California in San Francisco, told San Francisco Chronicle writer, Kim Severson. "It’s not that fructose itself is so bad, but they put it in so much food that you consume so much of it without knowing it."

I believe that high fructose is a “bad sweetener,” but the fact that it is coming at us from all sides, seems to have compounded the health challenges, and especially the obesity problem. Even a low-fat, fruit-flavored yogurt can have 10 teaspoons of fructose-based sweetener in each serving.

HFCS alters the way metabolic-regulating hormones function.

Fruit-flavored yogurt can have 10 teaspoons of fructose-based sweetener in each serving.

A single 12-ounce can of soda has as much as 13 teaspoons of sugar in the form of HFCS.
A single 12-ounce can of soda has as much as 13 teaspoons of sugar in the form of HFCS. Because people drink twice the amount of sodas since 1970, amounting to about 56 gallons per person a year, we also consume twice the amount of HFCS. Back in 2001, we consumed almost 63 pounds of HFCS per person, according to the U.S. Department of Agriculture.

Journalist Greg Critser presents a compelling case against HFCS in his book, *Fat Land: How Americans Became the Fattest People in the World*. He argues that federal policies that aimed to stabilize food prices and support corn production in the 1970s led to a glut of corn and then to HFCS. With this cheaper way to sweeten food, producers pumped up the size and amount of sweet snacks and drinks on the market to increase profits.

Dr. George Bray, principal investigator of the Diabetes Prevention Program at Louisiana State University Medical Center, told the International Congress on Obesity that it was in the 1980s, just after HFCS was introduced in mass quantities that relatively stable obesity rates began to climb. By 2000, they had doubled.

The American Journal of Clinical Nutrition in 2002 published research that showed that teenagers’ milk consumption between 1965 and 1996 decreased by 36 percent (36%), at the same time soda consumption increased by more than 200 percent (200%). Dr. Bray says that he could find no single combination of environmental or food changes that were as significant to the rise in obesity than HFCS.
Other studies by researchers at the University of California at Davis and the University of Michigan have shown that consuming fructose, which is more readily converted to fat by the liver, increases the levels of fat in the bloodstream in the form of triglycerides.

Unlike other types of carbohydrate made up of glucose, fructose does not stimulate the pancreas to produce insulin. Studying the metabolic effects of fructose, Peter Havel, a nutrition researcher at University of California at Davis, has shown that fructose fails to increase the production of leptin, a hormone produced by the body's fat cells.

Both insulin and leptin act as signals to the brain to turn down the appetite and control body weight. And, in another metabolic twist, Havel's research shows that fructose does not appear to suppress the production of ghrelin, a hormone that increases hunger and appetite.

"Because fructose in isolation doesn't activate the hormones that regulate body weight as do other types of carbohydrate composed of glucose, consuming a diet high in fructose could lead to taking in more calories and, over time, to weight gain," he says.

Other researchers are finding additional problems with HFCS from increasing levels of fat to high risk of cancer.

You, the consumer, should be able to look at the label and see that one soda provides almost all the regular sugar a person should eat in a day.
Other researchers are finding additional problems with HFCS. A study in the Journal of the National Cancer Institute suggests that women whose diets were high in carbohydrates and fructose had an increased risk of colorectal cancer. Dr. Mel Heyman, chief of pediatric gastro-enterology and nutrition at University of California in San Francisco, is seeing sick children whose bodies have been overloaded with fructose from naturally occurring fructose in fruit juice combined with soda and processed food.

It is the fire hose flow of HFCS aimed at us that is the problem. Michael Jacobson, executive director of the Center for Science in the Public Interest, a consumer advocacy group, says that you, the consumer, should be able to look at the label and see that one soda provides almost all the sugar a person should eat in a day.

So, at least a big part of the obesity problem appears to be too much HFCS compounded by a low metabolism. Stopping the intake of trans-fatty acids is important. More exercise is needed, but couch potatoes do not like to hear that solution. For the lazy or those who cannot exercise properly, a German study may help.

Ice-water may be a secret for boosting your metabolism. A German study recently concluded that slowly sipping ice water can boost your metabolism and enable you to increase your calorie burning by more than 30% for 90 straight minutes. This secret was touted with the words: “No Exercise, No sweating, No dieting, and No self-denial”. Well, it may not be quite that dramatic, but it could help.
Lower temperatures can help burn off the fat. Prevention Magazine reported on ways to increase the metabolism. A slightly lower temperature at night can help get you a deeper, relaxing sleep. Your body burns more calories when you sleep cool. This can perhaps burn an extra 200 calories each night.

Another study was conducted on the immune system and cold exposure at the Dept. of Comparative Physiology, Faculty of Science, Charles University, Prague in the Czech Republic. A published paper on this study is entitled *Immune system of cold-exposed and cold-adapted humans*.

The aim of the study was to investigate whether or not the human immune system can be activated by a noninfectious stimulus, thereby improving the physiological status of the individual. It was concluded that the stress-inducing noninfectious stimuli, such as repeated cold water immersions, which increased metabolic rate due to shivering, elevated blood concentrations of catecholamines, activating the immune system to a slight extent. The biological significance of the changes observed remains to be elucidated.

You may not want to change your lifestyle by jumping into freezing water every day, but that might make it easier to cut back on the fire hose amount of high fructose corn syrup and bad sugars as the first step toward a better life.

Incidently, it appears to the author that the other noninfectious stimuli to the human immune system are the nine sugars. Also, each of the nine sugars are non-stress-inducing noninfectious stimulus. Eating good sugars seems more appealing that jumping into freezing water.
When I started writing this book, my objective was to help you stay mentally active and keep the neurons firing. My desire was to help you not worry so much because there is hope regardless of how big the problem may appear. I would encourage you to eat more super foods – more brain foods and eat and drink high pH foods and drinks, to drink lots of clean water, preferably oxygenated and higher pH water (less acidic as I explained in Chapter 20).

My purpose is to help you encourage others to also exercise more and breath deeply to get more oxygen to your brain and the rest of your body. I told you to take a big breath and said, “There now, you just got more oxygen into your lungs, and 25% of it is now on its way to your brain.”

This book was designed to help you fulfill your purpose in life. You can make new friends and keep the ones you have because you make wise choices and your friends are worthy of you as a friend. You can encourage others too move toward that which will help you and them make today better than yesterday. Don’t just do random acts of kindness, make it your joyful lifestyle. Don’t just listen to good music everyday, really enjoy it. Continue to daily read and listen to good humor, even if it must come past your own lips. Read Scripture and other meaningful positive writings. Do not let negative people put negative thoughts in your head. Be happy. Be filled with joy which can be your strength. Continue to make each day better than the day before.

The closing chapter is my challenge to you along with my hope and prayer that your life will be better tomorrow because you have taken to heart the words within your hands.

Your reward is just ahead!
A major cause for obesity
A major cause for obesity
You are to be commended for getting to chapter 38. Are you ready to receive the reward you deserve? Have you chosen to take charge of your own health? Are you really ready to take authority over your own wellness? As you take authority over your own life, the rewards may be much more than just added years of quality life.
I presented the plan for wellness and long life to a wealthy man some years ago. I still remember it clearly. He was doing much better and in fact the doctor had told him that he would probably live maybe twenty years longer than the doctor or he thought he would live. In a very concerned tone of voice he said to me, “But, do you know how much this is going to cost me?”

I said, “Man, get your priorities and values right.” Perhaps it was insensitive of me, but I added, “The undertaker will be your last bill”.

In the first chapter, I mentioned the two published papers on our Alzheimer’s Nutritional Pilot Survey.

We are also training physicians (ACCME), nurses, Rns, LPNs, LVNs, and NPs (ANCC), pharmacists (ACPE), dentists (AGD), dietitians, chiropractors (in some states) and other healthcare professionals in the science of glycomics with Continuing Medical Education credits and Continuing Education Units.

We have documented evidence that indeed it is possible to Expand the mind and Improve the brain.

Safe, non-toxic, Evidence Based Integrative Nutritional Pilot Surveys without harmful drugs have opened the door to possibilities for improving and extending the quality of life. One of our team said, “This is beyond our greatest expectations.”

I responded, “No, our expectations are high because I believe we have been shown what to do.”

Everyone is unique and respond differently. We have non-responders, some slow responders and some hyper-responders.

While we have had some non-responders, for others, it is like an awakening or like a revisiting of the movie Cocoon.
My burning desire is to see as many people helped as possible. There are three basic results in our Nutritional Pilot Surveys: (1) non-responders; (2) slow responders; and (3) hyper-responders.

I believe that we are close to discovering the exact marker for knowing why the hyper-responders are responding like they are. When we are able to do this, it may be possible to give back to the children, for some extended time, one of their greatest joys - more time with their grandpa and grandma.

Alzheimer’s patients soon lose their ability to work with figures and to do minor math. One of the men with Alzheimer’s in our Nutritional Pilot Survey was what we terms to be a slow responder but had improved over the months to the extent that he had a desire to again do their income tax filing for the year. Instead of having a fear of number, he chose to do work with math again. I told one of the doctors working with us that if this Alzheimer’s patient gets a refund, we know this is working.

My objective is to see that we find the marker that is enabling some to become hyper-responders. Looking for the marker is like looking for a needle in the haystack. The needle will be much easier when you have a powerful magnet and you are close to the needle.

1) We know the needle is there in the haystack.
2) We believe we are close to the needle.
3) We have designed a powerful magnet (the plan) that will help us find the needle.

This allegory is to help you, the reader, better understand where we are in our research plans.
The Nutritional Pilot Survey integrated the best of super foods including super sugars into a system that included our staff regularly praying for the people in the studies. We could make no medical claims, nor could any single nutrient take the credit for the results. It was a system including prayer. The nutrients came from different sources and not from any single company. We also encourage the family to love the individual and do everything they could to make the surrounding pleasant and joyful including beautiful music when possible. Many family members called into our office and requested prayer.

One truly remarkable family wanted to give their matriarch a better quality of life. She was diagnosed with Alzheimer's, was in a nursing home, had not spoken or recognized anyone in over three years, and was sleeping in a fetal position. We entered her into our Nutritional Pilot Survey of a specific regimen based on the science of glycomics. In a few weeks she was sleeping on her back instead of the fetal position.

Now remember, she had no cognitive activity and had not spoken in three years. One evening the nurse came by her room in the nursing home to look in on her. The elderly matriarch turned to the nurse and spoke her first words in over three years, "How are you tonight, Betty?"

Nurse Betty literally fainted in the doorway. At Christmas, the family took mom home where she recognized everyone. When her grandson, who had returned from Iraq, came home, they asked her if she knew who that was. Her answer was, "of course", and called her grandson by name. The family was able to take her out of the nursing home and place her in an assisted care facility where she enjoys life playing cards and visiting with friends and family.

Integrating glycomics with standard of care has the possibility of delaying the onslaught of dementia, Alzheimer's, and other neurodegenerative diseases.
The economical impact this discovery can have on the nation is astounding. There are currently some six million (6,000,000) Alzheimer's patients in the United States with an expected fifteen million (15,000,000) within the next few years. The current cost of caring for these victims is estimated at $75,000 per person year per year. That is an annual economic burden of four hundred and fifty billion dollars ($450,000,000).

Delaying the onslaught of Alzheimer's for 15 million patients could result in a national savings of 1.125 Trillion dollars ($1,125,000,000,000) per year.

The world is full of problems made by bad choices. Someone's bad choice has contributed to every problem there is. I was asked the question about why in the world is the world in such a mess. My response was, “Because man spoke chaos into existence. Man spoke it and then took action on his negative word. Do not blame God or anything else. The world is in the chaos it is in because of man’s bad choices.” Those who succeed must take authority over their circumstances.

Your perspective toward those problems determine, not only your quality of life, but it can impact your whole sphere of influence. You will touch others.

Your life is made up of lots of problems – big problems and little problems. A lot of the little problems are called cells. These cells which make up your body need help and you are the one that has been called to help them.

Plus, everyone you know also has problems, lots of problems. They too need your help. Don’t be overwhelmed that your world is made up of problems.

Your view of the circumstances and the problems determine your quality of life. Your life is made up by your perspective, propensity, priority, and potential concerning the problem.
Life is all about problems, your problems and other people’s problems.

Life is all about solutions, your solutions and other people’s solutions.

Your perspective tips the scale.

- Life is all about **problems**, your problems and other people’s problems.

- Your **perspective** toward those problems determine, not only your quality of life, but it can impact your whole sphere of influence. You will touch others in a positive way especially those whose problems you help solve.

- Your **propensity** will determine the outcome. When you have the propensity to do something about the problems, they become opportunities.
Your life will continue to be a chaotic journey if you do not overcome the propensity to just let the problems go. Problems normally will not solve themselves.

- **Your priorities** will determine the speed in which the problems are resolved.

- **Your potential** for richness of rewards will be determined by your seeing and believing in the potential that the problems can and will bring.

You may think there is no hope or that all your efforts are worthless. I remember a story of a Roman slave years ago who was required by his master to carry a pile of rock to the top of a hill. He obeyed and over time transported the entire pile of rock to the top of the hill. Finished, he reported to his master the accomplishment. His master then instructed him to return each rock down the hill and put the pile back where it was. The slave obeyed and accomplished this second phase of what seemed to be foolish futility. Because of his obedience to his master, the slave became one of the strongest warriors in the Roman Empire. The “foolish futility” brought his body into shape by carrying rocks up and down the hill.

Because of your desire to **Expand your mind and Improve your brain** you will be required to do some things aggressively or all the words of this book will have fallen on fallow ground and never take root in the soil of your soul.

**Designing** the marks in life that you want to hit are vital for a full and meaningful life. Sometimes I start my training with a large white board in front of the room. I place a small dot in the middle of the board and ask the audience what they see. Of course, the answer is, “A dot.” It was a trick question to get them to see more than the dot. My response is, “*No, this is a big white board with a little dot on it.*”

It will take effort to hit your marks, to achieve your objectives, in life. But, there are only three ways you can miss the marks.
The first sure way to miss the mark is to shoot away from the big white board. If you do not aim at the mark, you are not likely to hit it. The second way is knowing what to do but simply neglecting to take action. The third way is ignorance. We are all ignorant in most things. There is nothing wrong with being ignorant. Just don’t stay there. You and I need to **Expand our minds and Improve our brains.**

So, ignorance, neglect, and rebellion are the only three ways you can miss the mark. I am not the first one to teach this principle. Two thousand years ago The Teacher told the three stories back to back about the lost sheep, the lost coin, and the prodical son. The sheep was lost out of ignorance. The coin was lost out of ignorance. The coin was lost from neglect. The prodical son was lost out of rebellion. The sheep was saved. The lost coin was found. And, the prodical son returned. The situation for each of these seemed impossible at the time.

You now must respond by accepting or rejecting the two remaining pathways to keep you from missing the mark. You are no longer ignorant. That leaves neglect and rebellion. So, don’t act like you are ignorant any longer. You know the potential and the consequence. To acquiesce is to accept the consequences. To not take action is negligence. Procrastination is negligence. To dig your heels in and reject the proper instruction is rebellion.

I challenge you to bring your life into order. Sharpen your perspective. Correct your propensity. Make your priorities right.

In closing, allow me to tell one quick story. A few years ago someone that I knew very well told me that it seemed his life was beyond hope and beyond repair.

He had gone through bankruptcy and divorce. His children were taken to another state and estranged from him. It not only seemed like there was no hope, there was no sign of hope. He was dejected, defeated, despondent, depressed, and he thought doomed. He heard the hissing in his ears, “You have failed. You are a failure. You have failed again. You are a total failure.”
He said his life was like a scrambled egg and you can never unscramble an egg. Then in a kind of nervous jest he recited the children’s poem of Humpty Dumpty, “Humpty Dumpty sat on a wall. Humpty Dumpty had a great fall. And, all the king’s horses and all the king’s men couldn’t put Humpty Dumpty back together again.”

Then, in a low voice, almost a whisper, I heard and uttered the words myself, “You are right, all the kings horses and all the king’s men cannot put Humpty Dumpty back together again. ... But, the King can.”

I knew that man very well, because I was that man.

Fortunately, I did not continue to focus on the scrambled egg, the spilt milk, the broken cup, the cup half empty nor the cup half full. I decided to take responsibility and fill the cup. The cup was empty to start with.

All the bad stuff, that you can call by many names makes wonderful fertilizer, but it has to be plowed under. Just leaving it there stinks. I could not continue to just look at it and worry about this mess. Nor, could I continue to ignore the mess. I had to get down on my hands and knees and start cleaning my surroundings. Then a brilliant idea struck me. While I was down on my knees, I might as well pray.

“Father, I commit my work to You, and I thank you that my thoughts are established*. I thank You that today can be better than yesterday and tomorrow can be better than today. I am grateful for the opportunities of today.

* Proverbs 16:3 KJV
Many different reference resources are used for explaining the meaning of words and phrases. While great care is given to accuracy, the author understands there are disagreements throughout the science community on many of the subjects referenced here. He would greatly appreciate comments from any learned reader regarding new information that may update the glossary in future editions.

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**Acetyl Co-A** Chapter 17: 107.
*Acetyl-CoA* is an important molecule in metabolism, used in many biochemical reactions. Its main use is to convey the carbon atoms within the acetyl group to Krebs Cycle to be oxidized for energy production. Chemically it is the thioester between coenzyme A (a thiol) and acetic acid (an acyl group carrier). Acetyl-CoA is produced during the second step of aerobic cellular respiration, pyruvate decarboxylation, which occurs in the matrix of the mitochondria. Acetyl-CoA then enters Krebs Cycle.

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*Wikipedia, the free encyclopedia*

**acetylcholine** Chapter 32: 182-184.
*(Ach)* The chemical compound **acetylcholine** was the first neurotransmitter to be identified. It is a chemical transmitter in both the peripheral nervous system (PNS) and central nervous system (CNS). Acetylcholine is the neurotransmitter in all autonomic ganglia, which means that it is a chemical that allows neurons to communicate with each other. An **acetylcholine receptor** (abbreviated **AChR**) is an integral membrane protein that responds to the binding of the neurotransmitter acetylcholine.

**acetylcholinesterase** Chapter 32: 182-183.
*(AChE)* **Acetylcholinesterase** is an enzyme that breaks down the neurotransmitter acetylcholine at the synaptic cleft (the space between two nerve cells) so the next nerve impulse can be transmitted across the synaptic gap. (Pesticides of the organophosphate and carbamate types act to paralyze and kill insects by inhibiting their acetylcholinesterase.)
Ach  Chapter 32: 182-184.

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acid  \( (-\text{s}; -\text{ic}; -\text{ity}) \)  Chapter 11:75; Chapter 15: 93-98; Chapter 18:113; Chapter 20: 119-124; Chapter 26: 155-158; Chapter 28: 165-166; Chapter 32: 182; Chapter 36: 207 #16; 208 #37; 212 #96; 220; 223-224; Chapter 37: 233, 232.

An acid is traditionally considered any chemical compound that has a pH less than 7.0. Acid has electrical conductivity and are electrolytes. Acids can be determined by a simple litmus test.

acidosis  Chapter 28: 166.

Acidosis is an increased acidity (an increased hydrogen ion concentration).

ADD (Attention Deficit Disorder)  Chapter 4: 29; Chapter 11: 75; Chapter 36: 206, 213 #107.

Attention Deficit Disorder describes one who has an impaired ability to stay focused. See ADhD.

addiction  Chapter 10: 65-70; Chapter 36: 215 #133.

An addiction is a recurring compulsion by an individual to engage in some specific activity. The term is often reserved for drug addictions but it is sometimes applied to other compulsions, such as problem gambling, pornography, and compulsive overeating. Factors that have been suggested as causes of addiction include genetic, biological/pharmacological and social factors.

- From Wikipedia, the free encyclopedia
Adenosine triphosphate (ATP) Chapter 17: 105-110.  
Adenosine triphosphate  The mitochondria makes the final process of glucose conversion to ATP. Two molecules of ATP are made from one molecule of glucose processed through the mitochondria reactor.

ADhD  Chapter 4: 29; Chapter 11: 75; Chapter 36: 206, 213 #107.  
Attention Deficit Hyperactive Disorder has degrees of complications as depicted by this illustration from Joseph Biederman and Stephen Faraone, Harvard Mahoney Neuroscience Institute Letter, Winter 1996 Volume 5 Number 1. When the various symptoms overlay, the complexity increases. The positive side of ADhD is that often these are the people who get things done. Often the individual is smarter in many ways. Experience reveals that the projects at hand often overshadow the need to please anyone but themselves and consequently other people are frustrated as Mr. Wilson becomes with Dennis in the cartoon.

adrenaline  Chapter 36: 207 #17.  
Epinephrine or adrenaline is a hormone. It is a catecholamine, a sympathomimetic monoamine derived from the amino acids phenylalanine and tyrosine. The Latin roots ad-+renes and the Greek roots epi+-nephros both literally mean "on/to the kidney" (referring to the adrenal gland, which sits atop the kidneys and secretes epinephrine). Epinephrine is sometimes shortened to epi.

ADT  Chapter 4: 29; Chapter 11: 75; Chapter 36: 206, 213 #107.  
Attention Deficit Trait.  See ADD and ADhD.

AIDS  Chapter 3: 25; Chapter 8:55.  
AIDS stands for acquired immunodeficiency syndrome. It is the most advanced stages of infection with the human immunodeficiency virus (HIV). HIV is a virus that kills or damages cells of the body's immune system. HIV most often spreads through unprotected sex with an infected person. AIDS may also spread by sharing drug needles or through contact with the blood of an infected person. Women can give it to their babies during pregnancy or childbirth. The first signs of HIV infection may be swollen glands and flu-like symptoms. These may come and go a month or two after infection. Severe symptoms may not appear until months or years later.  

There is considerable confusion and misunderstanding about AIDS. Some researchers do not associate HIV with AIDS as much as others do. AIDS is the disease that is generally characterised by a decline in CD4+ T lymphocytes circulating in the blood, which are responsible for cell-mediated immunity. As a result, the patient becomes susceptible to opportunistic infections (those affecting weakened immune systems) such as tuberculosis, pneumonia, meningitis, and other diseases caused by parasites, bacteria and viruses that can enter and multiply in the cells of the body. However, models that assume the human immunodeficiency virus (HIV) plays a central role in disease progression run into considerable difficulties. If the decline in CD4+ cells is due to HIV killing the cells, then there should be a correlation between the 'viral load', which estimates the amount of virus in the body, and the CD4+ cell count. But that is not the case. CD4+ cell count is not a reliable indicator of disease progression at all, nor for that matter is viral load (Chapter 2, Unraveling AIDS, ISIS Report), and they bear little relationship to each another. This has been confirmed in a recent study on untreated HIV+ individuals. Rebecca V. Culshaw, Ph.D. (Dr. Culshaw is a Canadian mathematical biologist working as an Assistant Professor of Mathematics at University of Texas at Tyler.)

Aikido  Chapter 22: 132.
Aikido Aikido is a Japanese martial art that emphasizes joining with an attack and redirecting the attacker's energy, as opposed to meeting force with force, and consists primarily of body throws and joint-locking techniques. In addition to physical fitness and technique, mental training, controlled relaxation, and development of "life energy" or "spirit" (ki) are emphasized in aikido training.

alcohol (-ic)  Chapter 2: 19; Chapter 10: 66-67; Chapter 33: 188; Chapter 35: 199-204; Chapter 36:  207 # 20; 213 #101.
The Journal of the American Medical Association JAMA) defines alcoholism as "a primary, chronic disease characterized by impaired control over drinking, preoccupation with the drug alcohol, use of alcohol despite adverse consequences, and distortions in thinking." The DSM-IV (the standard for diagnosis in psychiatry and psychology) defines alcohol abuse as repeated use despite recurrent adverse consequences; further defining alcohol dependence as alcohol abuse combined with tolerance, withdrawal, and an uncontrollable drive to drink. According to the APA Dictionary of Psychology, alcoholism is the popular term for alcohol dependence.
**Glossary**

**altering gene expression** Chapter 3: 24; Chapter 12: 79; Chapter 36: 209 #51.
Altering gene expression is not necessarily altering the DNA but affecting the results of DNA sequencing. Scientists have learned that the DNA coding does not include the codes to turn off and on the sequencing. The different genes can be turned off and on by micro-contaminates or micro-nutrients that become attached to the double helics. An appropriate word: degenerative (de-gene-ra-tive).

- J. C. Spencer

**alkalinity** Chapter 15: 94; Chapter 18: 113; Chapter 20: 119-124; Chapter 26: 156; Chapter 28: 166.
Alkalinity is traditionally considered any chemical compound that has a pH higher than 7.0. Alkaline solutions have electrical conductivity and are electrolytes. Alkaline can be determined by a simple litmus test.

**Alzheimer's** Chapter 1: 12-14; Chapter 2: 17; Chapter 3: 28; Chapter 4: 32-33; Chapter 12: 80; Chapter 14: 90; Chapter 16: 100; Chapter 27: 161; Chapter 32: 182, 184; Chapter 36: 211 # 83; Chapter 38: 236-239.
**Alzheimer's disease** (AD) is the most common form of dementia among older people. Dementia is a brain disorder that seriously affects a person's ability to carry out daily activities.

**AMA** 10.
The **American Medical Association** is know as the voice of the physician. Approximately forty percent (40%) of the doctors in the US are members.

**amino acids** Chapter 20: 123; Chapter 32: 182.
**Amino acids** are the basic building blocks of enzymes, hormones, proteins, and body tissues. A peptide is a compound consisting of 2 or more amino acids. Oligopeptides have 10 or fewer amino acids. Polypeptides and proteins are chains of 10 or more amino acids, but peptides consisting of more than 50 amino acids are classified as proteins.

**amyloid protein** Chapter 16: 100; Chapter 32: 184.
**Amyloid** is any of a number of complex proteins that are deposited in tissues. The deposition of amyloid occurs in a number of diseases. In Alzheimer's disease, the beta-amyloid protein may kill neurons. Amyloid may be deposited widely in the body and may be organ-specific as in the pancreas for diabetes, or the central nervous system, as in Alzheimer's, Parkinson, or Huntington.
anionic  Chapter 20: 119-124.  
Anions are negatively charged ions. They are negatively charged because there is one more electron in its orbits than there would be should it be stable (Eg.: A hydrogen nucleus with two electrons).

antioxidants  Chapter 3:25; Chapter 16:  99-104.  
Antioxidants are molecules that slow or prevent the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals, which start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing radical intermediates, and inhibit other oxidation reactions by being oxidized themselves. Although oxidation reactions are critical for life, they can also be damaging; hence, plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, and vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidases. Too low levels of antioxidants or inhibition of the antioxidant enzymes causes oxidative stress and may damage or kill cells.

apple cider vinegar  Chapter 15: 95.  
Apple cider vinegar is made from apple cider under the right conditions. The mother gives life to vinegar. Like yeast starter for bread dough, a vinegar mother develops spontaneously under the right conditions. Mother of vinegar is that curious jelly-like formation of living bacteria and yeast which fosters the production of acetic acid. This gelatinous, slippery membrane while not appetizing in appearance, is completely harmless and does not have to be discarded. It can be filtered out using a coffee filter, or simply left in and ignored. A healthy mother can be divided without harm.

approach  Chapter 1: 13; Chapter 7: 48; Chapter 11: 71-76; Chapter 22: 133; Chapter 36: 206.  
In the book the word approach denotes moving toward the desired director for optimal benefit.
Glossary

arthritis  Chapter 36: 206; 208 #25.
Arthritis is a group of conditions where there is damage caused to the joints of the body. Arthritis is the leading cause of disability in people over the age of 55. There are many forms of arthritis, which may have a different cause. Rheumatoid arthritis and psoriatic arthritis are autoimmune diseases in which the body is attacking itself. Septic arthritis is caused by joint infection. Gouty arthritis is caused by deposition of uric acid crystals in the joint that results in subsequent inflammation. Additionally, there is a less common form of gout that is caused by the formation of rhomboidal shaped crystals of calcium pyrophosphate. This form of gout is known as pseudogout. The most common form of arthritis, osteoarthritis is also known as degenerative joint disease and occurs following trauma to the joint, following an infection of the joint or simply as a result of aging. There is emerging evidence that abnormal anatomy may contribute to early development of osteoarthritis.

asthma  Chapter 36: 215 #26.
Asthma is a chronic disease that affects the airways. The airways are the tubes that carry air in and out of your lungs. The inside walls of the airways become inflamed (swollen). The inflammation renders the airways very sensitive, and become allergic. When the airways contract, they become more narrow, restricting the air flow to the lungs. Traditional medicine has no cure.

atherosclerosis  Chapter 17: 108; Chapter 36: 209 #56.
Atherosclerosis is the hardening and narrowing of the arteries. It is caused by the buildup of plaque on the inside of walls of the arteries. Arteries are blood vessels that carry oxygen-rich blood from the heart to other parts of the body. Plaque is made up of fat, cholesterol, calcium, and other substances found in the blood. As it grows, the buildup of plaque narrows the inside of the artery and, in time, may restrict blood flow. The two types of plaque are (1) hard and stable, and (2) soft and unstable. Hard plaque causes artery walls to thicken and harden. Soft plaque is more likely to break apart from the walls and enter the bloodstream. This can cause a blood clot that can partially or totally block the flow of blood in the artery. When this happens, the organ supplied by the blocked artery starves for blood and oxygen. The organ's cells may either die or suffer severe damage.

ATP  Chapter 17: 105-110.
Adenosine triphosphate The mitochondria makes the final process of glucose conversion to ATP. Two molecules of ATP are made from one molecule of glucose processed through the mitochondria reactor.
Attention Deficit Disorder (ADD) Chapter 4: 29; Chapter 11: 75; Chapter 36: 206; 213 #107.
Attention Deficit Disorder describes one who has an impaired ability to stay focused. See AdhD.

Attention Deficit Hyperactive Disorder Chapter 4: 29; Chapter 11: 75; Chapter 36: 206; 213 #107.
(See ADhD) ADhD has degrees of complications as depicted by this illustration from Joseph Biederman and Stephen Faraone, Harvard Mahoney Neuroscience Institute Letter, Winter 1996 Volume 5 Number 1. When the various symptoms overlay, the complexity increases. The positive side of ADhD is that often these are the people who get things done. Often the individual is smarter in many ways. Experience reveals that the projects at hand often overshadow the need to please anyone but themselves and consequently other people are frustrated as the cartoon of Mr. Wilson and Dennis.

autism Chapter 11: 75; Chapter 24: 145.
Autism is the most common condition in a group of developmental disorders known as the autism spectrum disorders (ASDs). Autism is characterized by impaired social interaction, problems with verbal and nonverbal communication, and unusual, repetitive, or severely limited activities and interests. Other ASDs include Asperger syndrome, Rett syndrome, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (usually referred to as PDD-NOS). Experts estimate that three to six children out of every 1,000 will have autism. Males are four times more likely to have autism than females.

autopsies Chapter 32: 182.
An autopsy, also known as a post-mortem examination, necropsy, or obduction, is a medical procedure that consists of a thorough examination of a corpse to determine the cause and manner of death and to evaluate any disease or injury that may be present. It is usually performed by a specialized medical doctor called a pathologist.

behavior Chapter 4: 30; Chapter 7: 48; Chapter 9: 61; Chapter 11: 71-72; Chapter 22: 131-133; Chapter 27: 160; Chapter 30: 172; Chapter 35: 200; Chapter 36: 214 #119.
Behavior refers to the actions or reactions of an object or organism, usually in relation to the environment. Behavior can be conscious, subconscious, or, overt or covert, and voluntary or involuntary. In humans, behavior is controlled by the endocrine system and the nervous system. Human behavior (and that of other organisms and mechanisms) can be common, unusual, acceptable, or unacceptable.
Glossary

biliary tract  Chapter 36: 212 #91.
One of the most common causes of extrahepatic biliary obstruction is choledocholithiasis with one or more stones in the common bile duct or common hepatic duct causing biliary obstruction. Gallbladder diseases include gallstones, tumors, and acute acalculous cholecystitis. In the book we discuss cancer in this area of the body that may be caused by a high sugar diet.

biochemistry  Chapter 6: 44; Chapter 19: 117; Chapter 36: 218.
Biochemistry is the study of the chemical processes and transformations in living organisms. It deals with the structure and function of cellular components, such as proteins, carbohydrates, lipids, nucleic acids, and other biomolecules.

biologist  Chapter 27: 160.
A biologist is a scientist devoted to and producing results in biology through the study of organisms. Typically biologists study organisms and their relationship to their environment. Biologists involved in basic research attempt to discover underlying mechanisms that govern how organisms work. Biologists involved in applied research attempt to develop or improve medical, industrial or agricultural processes. Some biologists work in management positions coordinating or supervising research. Technicians perform specialized tasks using laboratory equipment. There are many types of biologists. Some deal with the macroscopic world, and others with the microscopic. There is much overlap between different fields, and it is often hard to classify a biologist as only one of them. Many jobs in biology as a field require an academic degree. A PhD (or equivalent) is generally required to direct independent research, and involves a specialization in a specific area of biology.
- U.S. Department of Labor

biology  Chapter 5: 37-38; Chapter 6: 44; Chapter 8: 55; Chapter 20: 120; Chapter 21: 126.
Biology is the study of all living things past and present.
biomedical  Chapter 21: 126.  
Biomedical scientists investigate tissue and body fluid samples to diagnose disease and monitor the treatment of patients. From screening cancer to diagnosing HIV, from blood transfusion to food poisoning and infection control, biomedical scientists are a vital part of modern healthcare, working in partnership with doctors, nurses and other healthcare professionals. Doctors treat their patients based on results of diagnostic investigation by biomedical scientists, while departments such as Accident & Emergency and operating theatres rely on biomedical scientists for emergency blood transfusions and blood grouping, testing for suspected overdoses, conditions such as leukaemia or patients suspected of having a heart attack.

- Institute of Biomedical Science

blood (-stream)  Chapter 1: 15; Chapter 4: 33; Chapter 15: 94; Chapter 20: 120-121; Chapter 26: 156-157; Chapter 28: 163-164; Chapter 31: 177; Chapter 32: 183; Chapter 33: 190; Chapter 34: 195-196; Chapter 36: 208 #39, 209 #42, 211 #82, 213: #105, 214 #115, #125; Chapter 37: 226-227, 229, 231.  
Life is in the blood that flows throughout your body in over 100,000 miles of passageways.

Blood-Brain-Barrier (BBB)

brain overload  Chapter 4: 29-34.  
Brain overload is expressed as Attention deficit trait (ADT) is a state caused when a normal brain is under too much stress, causing the person suffering ADT to make poor decisions, to ignore information and to limit their alternatives and options. The need is not a psychologist but a new perspective.

butyl benzyl phthalate  Chapter 3: 24.  
A highly toxic chemical found in plastics that can alter gene expression. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

calcium  Chapter 15: 94-96; Chapter 26: 157; Chapter 32: 184; Chapter 36: 207 #12.  
Calcium is the chemical element in the periodic table that has the symbol Ca and atomic number 20. It has an atomic mass of 40.078. Calcium is a soft grey alkaline earth metal, and is the fifth most abundant element in the Earth's crust. It is essential for living organisms, particularly in cell physiology, and is the most common metal in many animals.
The CA1 Region of the hippocampus area of the brain receives input from many brain regions and sensory systems. Post-synaptic moving of data storage in the brain that the author and his team have espoused seems to be supported by the team of PY Chang, PE Taylor, and MB Jackson at the Center for Learning and Memory, University of Texas, Austin, Austin, Texas. Their paper published in 2007 is entitled: Voltage Imaging Reveals the CA1 Region at the CA2 Border as a Focus for Epileptiform Discharges and Long-Term Potentiation in Hippocampal Slices. The paper reports: Voltage-sensitive-dye imaging was used to study the initiation and propagation of epileptiform activity in transverse hippocampal slices. A portion of the slices tested generated epileptiform discharges in response to electrical shocks under normal physiological conditions. The fraction of slices showing epileptiform responses increased from 44% to 86% when bathing [K(+)] increased from 3.2 to 4 mM. Regardless of stimulation site in the dentate gyrus and hippocampus, discharges generally initiated in the CA3 region. After onset, discharges abruptly appeared in the CA1 region, right at the CA2 border. This spread from the CA3 region to the CA1 region was saltatory, occurring prior to detectable activity in the intervening CA2 and CA3 regions. Discharges did eventually propagate smoothly through the intervening CA3 region into the CA2 region, but on a slower time scale. The surge in the CA1 region did not spread back into the CA2 region, but spread through the CA1 region toward the subiculum. Tetanic stimulation, theta bursts, and GABAA receptor antagonists failed to alter this characteristic pattern, but did reduce the latency of discharge onset. The part of the CA1 region at the CA2 border, where epileptic responses emerged with relatively short latency, also expressed stronger long-term potentiation (LTP) than the rest of the CA1 region. The CA2 region, where discharges had long latencies and low amplitudes, expressed weaker LTP. Thus, the CA1 region at the CA2 border has unique properties, which make this part of the hippocampus an important locus for both epileptiform activity and plasticity.

calpain Chapter 32:184.
Calpain is a neurotransmitter found in calcium that keeps the buildup of protein down.
cancer (-causing; -ous) Chapter 3: 24-25; Chapter 15: 94; Chapter 16: 99, 101; Chapter 17: 107; Chapter 18: 113; Chapter 29: 169; Chapter 34: 195; Chapter 36: 206, 207 #9; 210 #72; 211 #76, 212 #91, #92, #9, #99, 213 #112, 214 #120, #126, #127, 215 #128, #137, 216 #142, #143, 221-224.

Cancer is a disease characterized by a population of cells that grow and divide without respect to normal limits, invade and destroy adjacent tissues, and may spread to distant anatomic sites through a process called metastasis. These malignant properties of cancers differentiate them from benign tumors, which are self-limited in their growth and do not invade or metastasize (although some benign tumor types are capable of becoming malignant).

capillaries Chapter 36: 210 #69.
Unlike the arteries and veins, capillaries are very thin and fragile. The capillaries are actually only one epithelial cell thick. They are so thin that blood cells can only pass through them in single file. The exchange of oxygen and carbon dioxide takes place through the thin capillary wall. The red blood cells inside the capillary release their oxygen which passes through the wall and into the surrounding tissue. The tissue releases its waste products, like carbon dioxide, which passes through the wall and into the red blood cells. Arteries and veins run parallel throughout the body with a web-like network of capillaries, embedded in tissue, connecting them. The arteries pass their oxygen-rich blood to the capillaries which allow the exchange of gases within the tissue. The capillaries then pass their waste-rich blood to the veins for transport back to the heart. Capillaries are also involved in the body's release of excess heat. During exercise, for example, your body and blood temperature rises. To help release this excess heat, the blood delivers the heat to the capillaries which then rapidly release it to the tissue. The result is that your skin takes on a flushed, red appearance. If you hold your hand, for example, under hot water, your hand will quickly turn red for the same reason. Your arm, however, is not likely to change color because it is not actually feeling an increase in temperature.

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carboxyl group Chapter 20: 123.
Carboxyl group or carboxy group - COOH or CO₂H is a functional group present in amino acids and carboxylic acids. Its structure composed of one carbon atom attached to an oxygen atom by double bond and to a hydroxyl group by a single bond. It is often mentioned that a carboxyl group is a carbonyl group bonded to a hydroxyl group. The carboxyl group has one valence electron in its carbon atom, making it possible to be a part in a larger molecule by bonding through it.
cancerogens  Chapter 16: 100-101.
Cancerogens are agents that can cause cancer. In industry, there are many potential exposures to cancerogens.

cardiovascular  Chapter 36: 209 #50.
Cardiovascular disease refers to the class of diseases that involve the heart and/or blood vessels (arteries and veins). While the term technically refers to any disease that affects the cardiovascular system, it is usually used to refer to those related to atherosclerosis (arterial disease)... Most Western countries face high and increasing rates of cardiovascular disease. Each year, heart disease kills more Americans than cancer. Diseases of the heart alone caused 30% of all deaths, with other diseases of the cardio-vascular system causing substantial further death and disability. It is the number 1 cause of death and disability in the United States and most European countries. A large histological study (PDAY) showed vascular injury accumulates from adolescence, making primary prevention efforts necessary from childhood. By the time that heart problems are detected, the underlying cause (atherosclerosis) is usually quite advanced, having progressed for decades. There is therefore increased emphasis on preventing atherosclerosis by modifying risk factors, such as healthy eating, exercise and avoidance of smoking.

- From Wikipedia, the free encyclopedia

cataracts  Chapter 36: 209 # 54.
A cataract is a clouding of the natural lens, the part of the eye responsible for focusing light and producing clear, sharp images. The lens is contained in a sealed bag or capsule. As old cells die they become trapped within the capsule. Over time, the cells accumulate causing the lens to cloud, making images look blurred or fuzzy. For most people, cataracts are a natural result of aging. In fact, they are the leading cause of visual loss among adults 55 and older. Eye injuries, certain medications, and diseases such as diabetes and alcoholism have also been known to cause cataracts.

- St. Luke's Cataract & Laser Institute
**Glossary**

**catecholamines** Chapter 37: 231
Catecholamines are chemical compounds derived from the amino acid tyrosine containing catechol and amine groups. Some of them are biogenic amines. Catecholamines are water soluble and are 50% bound to plasma proteins, so they circulate in the bloodstream. The most abundant catecholamines are epinephrine (adrenaline), norepinephrine (noradrenaline) and dopamine, all of which are produced by phenylalanine and tyrosine. Tyrosine is created from phenylalanine by hydroxylation thanks to the enzyme, phenylalanine hydroxylase (tyrosine is also ingested directly from dietary protein). Tyrosine is then sent to catecholaminesecreting neurons. Here many kinds of reactions convert it to dopamine, to norepinephrine and epinephrine eventually. Catecholamines as hormones are released by the adrenal glands in situations of stress such as psychological stress or low blood sugar levels.

**cationic** Chapter 20: 119-124.
Cations are ions with positive charges. They are the opposite of anions, since they have one less electron than they should have when stable.

**cellobiose**
Cellobiose is a disaccharide with the formula \((\text{HOCH}_2\text{CHO} (\text{CHOH})_3 \text{O})_2\). The molecule is derived from the condensation of two glucose molecules linked in a \(\beta\) bond. It can be hydrolyzed by bacteria or cationic ion exchange resins to give glucose. Cellobiose has eight free alcohol (COH) groups and three ether linkages, which give rise to strong -inter- and intra-molecular hydrogen bonds. Cellobiose is not found in nature as the free sugar or as a glycoside. However it can be obtained by enzymatic or acidic hydrolysis of cellulose and cellulose rich materials such as cotton, jute, or paper. Cellulose is a polymer of glucose units linked by \(\beta\) bonds.

**cell (-s; -uar; -death)** Chapter 1: 14-15; Chapter 2: 18; Chapter 3: 23; Chapter 4: 31; Chapter 5: 35-37; Chapter 6: 43, 44; Chapter 7: 49-50; Chapter 8: 55; Chapter 11: 75; Chapter 12: 80; Chapter 14: 88; Chapter 15: 94; Chapter 16: 101-103; Chapter 17: 105-108; Chapter 18: 111, 114; Chapter 19: 116; Chapter 20: 119, 122-123.
The cell is the structural and functional unit of all known living organisms, and is sometimes called the "building block of life." Vital functions of an organism occur within cells, and all cells contain the hereditary information necessary for regulating cell functions and for transmitting information to the next generation of cells. The word cell comes from the Latin cellula, a small room.
cerebral cortex  Chapter 31: 176
The cerebral cortex is a structure within the vertebrate brain with distinct structural and functional properties. In non-living, preserved brains, the outermost layers of the cerebrum have a grey color, hence the name "grey matter". Grey matter is formed by neurons and their unmyelinated fibers while the white matter below the grey matter of the cortex is formed predominantly by myelinated axons interconnecting different regions of the central nervous system. The human cerebral cortex is 2-4 mm (0.08-0.16 inches) thick and plays a central role in many complex brain functions including memory, attention, perceptual awareness, "thinking", language and consciousness. The surface of the cerebral cortex is folded in large mammals where more than two thirds of the cortical surface is buried in the grooves, called "sulci". The phylogenetically more ancient part of the cerebral cortex, the hippocampus, is differentiated in five layers of neurons, while the more recent neo-cortex is differentiated in six basic layers. Relative variations in thickness or cell type (among other parameters) allows us to distinguish among different neocortical architectonic fields. The geometry of these fields seems to be related to the anatomy of the cortical folds and, for example, layers in the upper part of the cortical grooves (called gyri) are more clearly differentiated than in its deeper parts (called sulcal "fundi").
- From Wikipedia, the free encyclopedia

cerebrospinal fluid  Chapter 27: 160
Cerebrospinal fluid (CSF), Liquor cerebrospinalis, is a clear bodily fluid that occupies the subarachnoid space and the ventricular system around and inside the brain. More specifically the CSF occupies the space between the arachnoid mater (the internal layer of the brain cover, meninges) and the pia mater (the most superficial layer of the brain). Moreover it constitutes the content of all intra-cerebral (inside the brain, cerebrum) ventricles, cisterns and sulci (singular sulcus), as well as the central canal of the spinal cord. It is an approximately isotonic solution and acts as a "cushion" or buffer for the cortex, providing also a basic mechanical and immunological protection to the brain inside the skull.
- From Wikipedia, the free encyclopedia

CFS (chronic fatigue syndrome) (severe-) Chapter 33: 190-191; Chapter 36: 206
See Chronic fatigue and chronic fatigue syndrome
The word **character** as used in the book denotes a constellation of enduring traits that are manifested in the ways that an individual reacts to various challenges, what a person would do in secret. From the Greek word meaning "engraved or stamped mark, branding mark, symbol" that may refer to moral character.

**chaos**  Chapter 7: 48-51; Chapter 8: 57; Chapter 9: 61; Chapter 11:  71-76; Chapter 16: 103; Chapter 38: 239.

Current meaning of the word **chaos** is disorder from an earlier meaning of emptiness.

**cholesterol**  Chapter 36: 207 #41, 211 #82; Chapter 37: 227.

Also called: HDL, Hypercholesterolemia, Hyperlipidemia, Hyperlipoproteinemia, LDL

**Cholesterol** is a waxy, fat-like substance that occurs naturally in all parts of the body. Your body needs some cholesterol to work properly. But if you have too much in your blood, it can stick to the walls of your arteries. This is called plaque. Plaque can narrow your arteries or even block them. High levels of cholesterol in the blood can increase your risk of heart disease. Your cholesterol levels tend to rise as you get older. There are usually no signs or symptoms that you have high blood cholesterol, but it can be detected with a blood test. You are likely to have high cholesterol if members of your family have it, if you are overweight or if you eat a lot of fatty foods. You can lower your cholesterol by exercising more and eating more fruits and vegetables. You also may need to take medicine to lower your cholesterol.

*National Heart, Lung, and Blood Institute*

Cholesterol is the precursor to the natural hormones: pregnenolone, progesterone, and dehydroepiandrosterone (better know as DHEA) from which all of your 87 main hormones, including estrogen and testosterone, can be produced. When the hormonal system is not working properly to convert the needed hormones from cholesterol, many complications can develop.

**Crohn's** Chapter 36: 207 #23

**Crohn's disease** causes inflammation of the digestive system. It is one of a group of diseases called inflammatory bowel disease. The disease can affect any area from the mouth to the anus. It often affects the lower part of the small intestine called the ileum. **Crohn's disease** seems to run in some families. It can occur in people of all age groups but is most often diagnosed in young adults. Common symptoms are pain in the abdomen and diarrhea. Bleeding from the rectum, weight loss, joint pain, skin problems and fever may also occur. Children with the disease may have growth problems. Other problems can include intestinal blockage and malnutrition. Treatment may include medicines, nutrition supplements, surgery or a combination of these options. Some people have long periods of remission, when they are free of symptoms.

_National Institute of Diabetes and Digestive and Kidney Diseases_

**chronic fatigue/chronic fatigue syndrome (severe-)** Chapter 33: 190-191; Chapter 36: 206

**Chronic fatigue and chronic fatigue syndrome (CFS)** have several names given to poorly understood and highly debilitating disorders of unknown cause, which is thought to affect approximately 4 per 1,000 adults in the United States and other countries, and a smaller fraction of children.

The disorder is marked by severe, chronic mental and physical exhaustion and by other specific symptoms, arising in previously healthy and active persons. Despite promising avenues of research, there remains no objective assay or pathological finding which is widely accepted to be diagnostic of CFS. It remains largely a diagnosis of exclusion, made on the basis of patient history and symptomatic criteria, although a number of tests exist which can help aid diagnosis. Although there is agreement on the genuine threat to health, happiness, and productivity posed by CFS, various physicians' groups, researchers, and patient activists champion very different nomenclature, diagnostic criteria, etiologic hypotheses, and favored treatments, resulting in ongoing controversy about nearly all aspects of the disorder. The name **chronic fatigue syndrome** is itself controversial, with some patient advocates and other authorities preferring terms such as **myalgic encephalomyelitis** ("ME" or "ME/CFS") and post-viral fatigue syndrome ("PVFS"), which imply specific underlying etiologies or pathologic processes.
CFS is not the same as "chronic fatigue" - while fatigue as a symptom is very common, CFS itself is relatively rare by comparison. Definitions (other than the 1991 UK Oxford criteria require a number of features, the most common being severe mental and physical exhaustion which is "unrelieved by rest" (according to the 1994 Fukuda definition), and may be worsened by even trivial exertion (a mandatory diagnostic criterion according to some systems). Most diagnostic criteria insist that the symptoms must be present for at least six months, and all insist on there being no other cause for them: i.e. the symptoms must be idiopathic, not caused by other medical conditions such as diabetes, hypothyroidism or anemia. CFS patients may report many other symptoms which are not included in all diagnostic criteria, including muscle weakness, cognitive dysfunction, hypersensitivity, orthostatic intolerance, digestive disturbances, depression, poor immune response, and cardiac and respiratory problems. It is unclear if these symptoms represent co-morbid conditions or are produced by the same underlying etiology as CFS itself. Some cases improve over time, and treatments (though none are universally accepted) bring a degree of improvement to many others, though resolution is rare.

CFS occurs more often, but not exclusively, in women, for unknown reasons. CFS is most easily diagnosed when formerly active adults become ill, and is most commonly diagnosed in young to middle aged adults, although it is also reported in adolescents and the elderly.

- From Wikipedia, the free encyclopedia

**clique(s) (- encodes)** Chapter 21: 126-127.
A *clique* as used in the book is a restricted group of neurons within a "school" of neurons who share common interests. These *cliques* are often a part of a larger group(s) and are normally associated with neurons that have been pre-programmed with specific interests. *See schools.*

**cocaine** Chapter 10: 67-68; Chapter 35: 201.
*Cocaine* is a crystalline tropane alkaloid that is obtained from the leaves of the coca plant. The name comes from the name of the coca plant in addition to the alkaloid suffix-*ine*, forming cocaine. In modern Western countries, cocaine has been a feature of the counterculture for over a century.
cognitive science Chapter 3: 24; Chapter 4: 32; Chapter 18: 113; Chapter 27: 159, 161; Chapter 32: 182; Chapter 33: 190; Chapter 34: 195; Chapter 38: 238.

Cognitive science is the interdisciplinary study of mind and intelligence, embracing philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology. Its intellectual origins are in the mid-1950s when researchers in several fields began to develop theories of mind based on complex representations and computational procedures. Its organizational origins are in the mid-1970s when the Cognitive Science Society was formed and the journal Cognitive Science began. Since then, more than sixty universities in North America, Europe, Asia, and Australia have established cognitive science programs, and many others have instituted courses in cognitive science.

- Stanford Encyclopedia of Philosophy

collagen Chapter 26: 157-158; Chapter 36: 209 #53.

Collagen is the main protein of connective tissue in humans and the most abundant protein in the human, making up about 25% of the total protein content. Collagen is one of the long, fibrous structural proteins whose functions are quite different from those of globular proteins such as enzymes; tough bundles of collagen called collagen fibers are a major component of the extracellular matrix that supports most tissues and gives cells structure from the outside, but collagen is also found inside certain cells. Collagen has great tensile strength, and is the main component of fascia, cartilage, ligaments, tendons, bone and teeth. Along with soft keratin, it is responsible for skin strength and elasticity, and its degradation leads to wrinkles that accompany aging. It strengthens blood vessels and plays a role in tissue development. It is present in the cornea and lens of the eye in crystalline form. It is also used in cosmetic surgery and burns surgery.

- From Wikipedia, the free encyclopedia

Collagen and Glycosylation: During natural sugar metabolism binding occurs with a reactive aldehydes and/or ketones, which then, attaches itself to amino acid groups. This is also called glycation or the Maillard reaction, which reduces the skin’s elasticity. Studies show that diabetes contributes to chemical aging, which includes skin aging. Inflammatory conditions breaks down collagen, as in, arthritis in joints and infections on the skin. An enzyme found in the body, collagenase, causes the breakdown of collagen.
Ulcerative colitis is a disease that causes ulcers in the lining of the rectum and colon. It is one of a group of diseases called inflammatory bowel disease. Ulcers form where inflammation has killed the cells that usually line the colon. Ulcerative colitis can happen at any age, but it usually starts between the ages of 15 and 30. It tends to run in families. The most common symptoms are pain in the abdomen and bloody diarrhea. Other symptoms may include anemia, severe tiredness, weight loss, loss of appetite, bleeding from the rectum, sores on the skin and joint pain. Children with the disease may have growth problems. About half of people with ulcerative colitis have mild symptoms. Several types of drugs can help control ulcerative colitis. Some people have long periods of remission, when they are free of symptoms. In severe cases, doctors must remove the colon.

- National Institute of Diabetes and Digestive and Kidney Diseases

colorectal cancer Chapter 37: 230.
Also called: Colon cancer, Rectal cancer. Cancer of the colon or rectum is also called colorectal cancer. In the United States, it is the fourth most common cancer in men and women.

communication Chapter 2: 18; Chapter 7: 51; Chapter 8: 53-58; Chapter 11: 75; Chapter 20: 123-124; Chapter 22: 131; Chapter 27: 161; Chapter 32: 183; Chapter 36: 218, 220.
Communication is a process that allows an exchange of information by any methods. Communication requires that some kinds of symbols or language be exchanged. Communication happens at many levels (even for one single action), in many different ways, and for all beings, and some machines. Many or all, fields of study dedicate some attention to communication, so when speaking about communication it is very important to be sure about what aspect of communication one is speaking about. Communication declares knowledge and experiences, gives advice and commands, and ask questions.
**constipation** Chapter 36: 215 #134.

**Constipation** may result in a person having fewer bowel movement (BM) than one per day. The stool can be hard and dry. Sometimes it is painful to pass. Some of the things doctors suggest to prevent constipation include: (1) Eat more fruits, vegetables and grains, which are high in fiber; (2) Drink plenty of clean water and other healthy liquids; (3) Get plenty of good exercise; (4) Take plenty of time to have a good BM. The ideal stool floats, indicating fiber which helps overcome constipation. While some doctors say that one BM each day is not important, others disagree and suggest developing a habit of three per day. The brain may be conditioned for the first BM of the day to be within minutes after you are awake. The second BM can be after a hearty breakfast. Each good meal should push the BM along so the toxic constipation does not further compromise your health.

- J. C. Spencer

**carbonyls** Chapter 37: 226-227.

In organic chemistry, a **carbonyl group** is a functional group composed of a carbon atom double-bonded to an oxygen atom: C=O.

**dehydroepiandrosterone** Chapter 4:33.

**Dehydroepiandrosterone (DHEA),** is a natural steroid prohormone produced from cholesterol by the adrenal glands, the gonads, adipose tissue, brain and in the skin (by an autocrine mechanism).

- From Wikipedia, the free encyclopedia

Cholesterol is the precursor to the natural hormones: pregnenolone, progesterone, and dehydroepiandrosterone (better know as DHEA) from which all of your 87 main hormones, including estrogen and testosterone, can be produced. When the hormonal system is not working properly to convert the needed hormones from cholesterol, many complications can develop.


Glossary

**dementia** Chapter 1: 13; Chapter 11: 75; Chapter 16: 100; Chapter 20: 122; Chapter 27: 161; Chapter 32: 182; Chapter 38: 238.

_Dementia_ is a word for a group of symptoms caused by disorders that affect the brain. It is not a specific disease. People with dementia may not be able to think well enough to do normal activities, such as getting dressed or eating. They may lose their ability to solve problems or control their emotions. Their personalities may change. They may become agitated or see things that are not there. Memory loss is a common symptom of dementia. However, memory loss by itself does not mean you have dementia. People with dementia have serious problems with two or more brain functions, such as memory and language. Many different diseases can cause dementia, including Alzheimer's disease and stroke. Drugs are available to treat some of these diseases. While these drugs cannot cure dementia or repair brain damage, they may improve symptoms or slow down the disease.

_National Institute of Neurological Disorders and Stroke_

**depolarization** Chapter 32: 182.

In biology, _depolarization_ is a decrease in the absolute value of a cell's membrane potential. Changes in membrane voltage in which the membrane potential becomes less positive or less negative are both depolarizations. The rising and falling phases of an action potential are often imprecisely called depolarization and hyperpolarization, respectively.

**design** Chapter 4: 33; Chapter 7: 48-51; Chapter 8: 53-56; Chapter 11: 73; Chapter 17: 107; Chapter 20: 119; Chapter 21: 127; Chapter 22: 133; Chapter 25: 152; Chapter 26: 155-156; Chapter 37: 232; Chapter 38: 237, 241.

The word _design_ may take on many shapes, be it visible shape of matter, applied arts, engineering, architecture, or other such creative endeavors of developing a plan for a product, structure, or component. All designs require a designer.

**dFMC (dorsal fronto-median cortex)** Chapter 11: 72.

The area of the brain that in 2007 neuroscientists at UCL (University College London) and Ghent University have found to be involved in thinking twice and checking impulsive behaviour.

**DHEA (dehydroepiandrosterone)** Chapter 4: 33.

See dehydroepiandrosterone.
diascoria  Chapter 4: 32.
There are several types of diascoria. It is reported that more drugs are made from this wild yam root than any other plant. Birth control pills are made from diascoria. When properly formulated and standardized, it can balance the hormones and is the precursor of dehydroepiandrosterone (DHEA).

dibutyl phthalate  Chapter 3: 23.
A highly toxic chemical found in plastics that can alter gene expression. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

diethyl hexyl phthalate  Chapter 3: 24.
A highly toxic chemical found in plastics that can alter gene expression. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

diethyl phthalate  Chapter 3: 24.
A highly toxic chemical found in plastics that can alter gene expression. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

disaccharide  Chapter 19: 114-115.
Disaccharide is also called Double Sugar, any substance that is composed of two molecules of simple sugars (monosaccharides) linked to each other. Sucrose, which is formed following photosynthesis in green plants, consists of one molecule of glucose and one of fructose; lactose (milk sugar), found in the milk of all mammals, consists of glucose and galactose; and maltose, a product of the breakdown of starches during digestion, consists of two molecules of glucose. Another important disaccharide, trehalose, also consists of two molecules of glucose, but they are linked in a way such that trehalose differs from maltose in that one molecule is turned upside down.
DNA Chapter 2: 17; Chapter 3: 23; Chapter 4: 30; Chapter 8: 53; Chapter 12: 78; Chapter 14: 88; Chapter 16: 101.

Deoxyribonucleic acid, or DNA, is a nucleic acid molecule that contains the genetic instructions used in the development and functioning of all known living organisms. The main role of DNA is the long-term storage of information and it is often compared to a set of blueprints, since DNA contains the instructions needed to construct other components of cells, such as proteins and RNA molecules. The DNA segments that carry this genetic information are called genes, but other DNA sequences have structural purposes, or are involved in regulating the use of this genetic information. Chemically, DNA is a long polymer of simple units called nucleotides, with a backbone made of sugars and phosphate atoms joined by ester bonds. Attached to each sugar is one of four types of molecules called bases. It is the sequence of these four bases along the backbone that encodes information. This information is read using the genetic code, which specifies the sequence of the amino acids within proteins. The code is read by copying stretches of DNA into the related nucleic acid RNA, in a process called transcription. Most of these RNA molecules are used to synthesize proteins, but others are used directly in structures such as ribosomes and spliceosomes. Within cells, DNA is organized into structures called chromosomes and the set of chromosomes within a cell make up a genome.

These chromosomes are duplicated before cells divide, in a process called DNA replication. Eukaryotic organisms such as animals, plants, and fungi store their DNA inside the cell nucleus, while in prokaryotes such as bacteria it is found in the cell's cytoplasm. Within the chromosomes, chromatin proteins such as histones compact and organize DNA, which helps control its interactions with other proteins and thereby control which genes are transcribed.

The discovery of the double helix structure of DNA is to science what the Mona Lisa is to painting. It's been called the single biggest discovery of all time. But it wasn't just stumbled upon — it was a race." Specifically, it was a race between two teams of young scientists working in Britain, as well as the esteemed chemist Linus Pauling, based in California. Already a Nobel laureate, Pauling may have been the favorite, but the discovery would ultimately be made by his British counterparts. Rosalind Franklin and Maurice Wilkins were trying to identify the structure by studying X-ray diffractions of the DNA molecule. But Jim Watson and Francis Crick studied a little of everything — including, to the consternation of some, the work of their competitors. A few have gone so far as to accuse Watson of stealing Franklin's X-ray work. In any case, Watson and Crick's inquisitive working style ultimately allowed them to determine the DNA structure.
first, in 1953 -- an achievement that led to their Nobel Prize in 1962. Meanwhile, Franklin passed away in 1958 from cancer.

- from a production Produced/directed by David Glover and edited by Joe Bini.

dopamine  Chapter 36: 206 #14.
Dopamine is a phenethylamine naturally produced by the human body. In the brain, dopamine functions as a neurotransmitter, activating the five types of dopamine receptors - D1, D2, D3, D4 and D5, and their variants. Dopamine is produced in several areas of the brain, including the substantia nigra. Dopamine is also a neurohormone released by the hypothalamus. Its main function as a hormone is to inhibit the release of prolactin from the anterior lobe of the pituitary. Doctors sometime may use the drug dopamine to act on the sympathetic nervous system, producing effects such as increased heart rate and blood pressure. However, the drug dopamine cannot cross the blood-brain barrier (BBB) and does not directly affect the central nervous system. To increase the amount of dopamine in the brains of patients with diseases such as Parkinson's disease, a precursor to dopamine, may be used that is able to cross the BBB.

dorsal fronto-median cortex (dFMC)  Chapter 11: 72.
The area of the brain that in 2007 neuroscientists at UCL (University College London) and Ghent University have found to be involved in thinking twice and checking impulsive behaviour.

dramatic event  Chapter 2: 20; Chapter 3: 23-28; Chapter 4: 30; Chapter 6: 42-43; Chapter 11: 75; Chapter 12: 79; Chapter 21: 127; Chapter 23: 140; Chapter 24: 145. Dramatic event as used in the book denotes a memorable event that you do not soon forget.

drugs 11-12, 16, 67-69, 184, 187, 191-195
A drug is any chemical or biological substance, synthetic or non-synthetic, that when taken into the organism's body, will in some way alter the functions of that organism. The word "drug" is usually used to refer specifically to medicine, as it affects the functioning of both mind and body. The word "drug" may be derived from the Dutch/Low German word "droog", which means "dry", since in the past, most drugs were from dried plant. See LD₅₀.
Glossary

**DVDs**  Chapter 2: 20; Chapter 3: 28; Chapter 4: 34; Chapter 12: 80; Chapter 29: 169; Chapter 35: 201-202.
**DVD** is the acronym "Digital Versatile Disc" or "Digital Video Disc") which is an optical disc storage media format used for data storage. It is primarily used are for movies, software, and data backup purposes, DVDs are of the same form factor as compact discs (CDs), but allow for 8 times the data storage capacity (single-layer, single-sided). DVDs represents a disruptive technology in that they replaced tape and film. Solid state storage of data, music and video is disruptive technology to the DVD industry.

**dyspepsia**  Chapter 36: 211 #77.
**Dyspepsia** means digestion and is chronic or recurrent pain or discomfort centered in the upper abdomen. It may include bloating, belching, nausea and/or heartburn. **Dyspepsia** is often caused by a person's lifestyle, such poor diet and smoking. It can be a symptom of something more serious like cancer of the stomach, peptic ulcer disease and some medications that brings the discomfort.

**ECT (electroconvulsive therapy)**  Chapter 29: 168.
See electroconvulsive therapy.

**eczema**  Chapter 36: 208 #46.
**Eczema** (also known as: Dermatitis) is a term for several different types of skin swelling. It is said to not be dangerous, but most types cause red, swollen and itchy skin. Factors that can cause eczema include other diseases, irritating substances, allergies and a person’s genetic makeup. Eczema is not contagious. The most common type of eczema is atopic dermatitis. It is an allergic condition that makes your skin dry and itchy. It is most common in babies and children. The medical establishment has no cure for eczema, but recommend attempting to prevent some types of eczema by avoiding irritants, stress and the things to which you are allergic.

**electrochemical**  Chapter 3: 22; Chapter 27: 159-160.
**Electrochemistry** is a branch of chemistry that studies the reactions which take place at the interface of an electronic conductor (the electrode composed of a metal or a semiconductor, including graphite) and an ionic conductor (the electrolyte). If a chemical reaction is caused by an external voltage, or if a voltage is caused by a chemical reaction, as in a battery, it is an **electrochemical** reaction. In general, electrochemistry deals with situations where an oxidation and a reduction reaction are separated in space. The direct charge transfer from one molecule to another is not the topic of electrochemistry.
electroconvulsive therapy (ECT)  Chapter 29: 168.
Electroconvulsive therapy (ECT) is sometimes used for treating severe depression and mental illness. ECT is a procedure in which electrical currents are passed through the brain to trigger a seizure. Researchers don't fully understand just how ECT works. But it's thought that the seizure causes changes in brain chemistry. Given in a series over several weeks, ECT can help alleviate the symptoms of certain mental illnesses. ECT today is far safer than it was just a few decades ago.

-Mayo Clinic

electrolysis  Chapter 16: 101; Chapter 20: 121.
Electrolysis is the process in which electric current passed through a substance causes a chemical change, usually the gaining or losing of electrons. It is carried out in an electrolytic cell consisting of separated positive and negative electrodes (anode and cathode, respectively) immersed in an electrolyte solution containing ions or in a molten ionic compound. Reduction occurs at the cathode, where electrons are added that combine with positively charged cations in the solution. Oxidation occurs at the anode, where negatively charged anions give up electrons. Both thus become neutral molecules. For historical reasons, electric current is defined to flow in the opposite direction to the flow of electrons. Thus, current is said to flow from the cathode to the anode, even though electrons flow in the opposite direction. Electrolysis is used extensively in metallurgy to extract or purify metals from ores or compounds and to deposit them from solution (electroplating). Electrolysis of molten sodium chloride yields metallic sodium and chlorine gas; that of a strong solution of sodium chloride in water (brine) yields hydrogen gas, chlorine gas, and sodium hydroxide (in solution); and that of water (with a low concentration of dissolved sodium chloride or other electrolyte) yields hydrogen and oxygen.

-Britannica Concise Encyclopedia

electrolyte (-s)  Chapter 15: 92-97; Chapter 20: 121; Chapter 27: 160; Chapter 28: 163-164; Chapter 36: 212 #108.
Electrolytes are salts that conduct electricity and are found in the body fluid, tissue, and blood. Examples are chloride, calcium, magnesium, sodium, and potassium. Sodium (Na+) is concentrated in the extracellular fluid (ECF) and potassium (K+) is concentrated in the intracellular fluid (ICF). Proper balance is essential for muscle coordination, heart function, fluid absorption and excretion, nerve function, and concentration.

-from the nephrologychannel for medical information
elucidated Chapter 37: 230
Elucidated is a term, used by those appearing to be educated, meaning to make clear. (Perhaps the word clarify would make the meaning more clear.) Elucidate is from the term to elucidate by shining a light on the subject, from licidus meaning to shine. From the same root as the word Lucifer from Lucifome, meaning to have a form of light, resembling light, but not The Light.

embryo
An embryo is a multicellular diploid eukaryote in its earliest stage of prenatal development. The child is called an embryo from the moment of fertilization until the end of the 8th week of gestational age in humans, whereafter it is instead called a fetus.

- From Wikipedia, the free encyclopedia

emphysema Chapter 36: 208 #55.
Emphysema is a type of chronic obstructive pulmonary disease (COPD) involving damage to the air sacs (alveoli) in the lungs. As a result, the body does not get the amount of needed oxygen. Emphysema makes it difficult to catch your breath. You may also have a chronic cough and have trouble breathing during exercise. The most common cause is cigarette smoking. To quit smoking can help prevent the disease. To stop smoking may keep it from getting worse. Conventional medical treatment includes inhalers, oxygen, medications and sometimes surgery to relieve symptoms and prevent complications.

endocrine system (hormonal system) Chapter 3:24; Chapter 20: 122-123; Chapter 36: 209 #40; 212 #85; Chapter 37: 230.
A hormone is a chemical messenger from one cell (or group of cells) to another. All multicellular organisms produce hormones (phytohormone). The function of hormones is to serve as a signal to the target cells; the action of hormones is determined by the pattern of secretion and the signal transduction of the receiving tissue. Hormones are produced by endocrine glands, but hormones are also produced by organ systems and tissue types. Endocrine hormone molecules are secreted directly into the bloodstream, while exocrine hormones (or ectohormones) are secreted directly into a duct, and from the duct they either flow into the bloodstream or they flow from cell to cell by diffusion in a process known as paracrine signaling. Hormonal regulation of some physiological activities involves a hierarchy of cell types acting on each other either to stimulate or modulate the release and action of a particular hormone. The secretion of hormones from successive levels of endocrine cells is stimulated by chemical signals originating
from cells higher up the hierarchical system. The master coordinator of hormonal activity is the hypothalamus acting on input it receives from the central nervous system. Other hormone secretion occurs in response to local conditions, such as the rate of secretion of parathyroid hormone by the parathyroid cells in response to fluctuations of ionized calcium levels in extracellular fluid.

Hormonal signaling across this hierarchy involves the following: (1) **Biosynthesis** of a particular hormone in a particular tissue. (2) **Storage and secretion** of the hormone. (3) **Transport** of the hormone to the target cell(s). (4) **Recognition** of the hormone by an associated cell membrane or intracellular receptor protein. (5) **Relay and amplification** of the received hormonal signal via a signal transduction process. This then leads to a cellular response. The reaction of the target cells may then be recognized by the original hormone-producing cells, leading to a down-regulation in hormone production. This is an example of a homeostatic negative feedback loop. (6) **Degradation** of the hormone.

As can be inferred from the hierarchical diagram, hormone biosynthetic cells are typically of a specialized cell type, residing within a particular endocrine gland (e.g. the thyroid gland, ovaries or testes). Hormones may exit their cell of origin via exocytosis or another means of membrane transport. However, the hierarchical model is an over simplification of the hormonal signaling process. Typically cellular recipients of a particular hormonal signal may be one of several cell types that reside within a number of different tissues, as is the case for insulin, which triggers a diverse range of systemic physiological effects. Different tissue types may also respond differently to the same hormonal signal. Because of this, hormonal signaling is elaborate and hard to dissect.

Most hormones initiate a cellular response by initially combining with either a specific intracellular or cell membrane associated receptor protein. A cell may have several different receptors that recognize the same hormone and activate different signal transduction pathways, or alternatively different hormones and their receptors may invoke the same biochemical pathway.

For many hormones, including most protein hormones, the receptor is membrane associated and embedded in the plasma membrane at the surface of the cell. The interaction of hormone and receptor typically triggers a cascade of secondary effects within the cytoplasm of the cell, often involving phosphorylation or dephosphorylation of various other cytoplasmic proteins, changes in ion channel permeability, or increased concentrations of intracellular molecules that may act as secondary messengers (e.g. cyclic AMP). Some protein hormones also interact with intracellular receptors located
in the cytoplasm or nucleus by an intracrine mechanism.

For hormones such as steroid or thyroid hormones, their receptors are located intracellularly within the cytoplasm of their target cell. In order to bind their receptors these hormones must cross the cell membrane. The combined hormone-receptor complex then moves across the nuclear membrane into the nucleus of the cell, where it binds to specific DNA sequences, effectively amplifying or suppressing the action of certain genes, and affecting protein synthesis. However, it has been shown that not all steroid receptors are located intracellularly, some are plasma membrane associated.

An important consideration, dictating the level at which cellular signal transduction pathways are activated in response to a hormonal signal is the effective concentration of hormone-receptor complexes that are formed. Hormone-receptor complex concentrations are effectively determined by three factors: (1) The number of hormone molecules available for complex formation (2) The number of receptor molecules available for complex formation and (3) The binding affinity between hormone and receptor. The number of hormone molecules available for complex formation is usually the key factor in determining the level at which signal transduction pathways are activated. The number of hormone molecules available being determined by the concentration of circulating hormone, which is in turn influenced by the level and rate at which they are secreted by biosynthetic cells. The number of receptors at the cell surface of the receiving cell can also be varied as can the affinity between the hormone and its receptor.

Most cells are capable of producing one or more molecules, which act as signalling molecules to other cells, altering their growth, function, or metabolism. The classical hormones produced by endocrine glands mentioned so far in this article are cellular products, specialized to serve as regulators at the overall organism level. However they may also exert their effects solely within the tissue in which they are produced and originally released. The rate of hormone biosynthesis and secretion is often regulated by a homeostatic negative feedback control mechanism. Such a mechanism depends on factors which influence the metabolism and excretion of hormones. Thus, higher hormone concentration alone can not trigger the negative feedback mechanism. Negative feedback must be triggered by overproduction of an "effect" of the hormone.

Hormone secretion can be stimulated and inhibited by: (1) Other hormones (stimulating- or releasing-hormones); (2) Plasma concentrations of ions or nutrients, as well as binding globulins; (3) Neurons and mental activity; (4) Environmental changes, e.g., of light or temperature.
One special group of hormones is the tropic hormones that stimulate the hormone production of other endocrine glands. For example, thyroid-stimulating hormone (TSH) causes growth and increased activity of another endocrine gland, the thyroid, which increases output of thyroid hormones. In order to release active hormones quickly into the circulation, hormone biosynthetic cells may produce and store biologically inactive hormones in the form of pre- or prohormones. These can then be quickly converted into their active hormone form in response to a particular stimulus.

Hormone effects vary widely, but can include: • stimulation or inhibition of growth, • induction or suppression of apoptosis (programmed cell death) • activation or inhibition of the immune system • regulating metabolism • preparation for a new activity (e.g., fighting, fleeing, mating) • preparation for a new phase of life (e.g., puberty, caring for offspring, menopause) • controlling the reproductive cycle.

In many cases, one hormone may regulate the production and release of other hormones. Many of the responses to hormone signals can be described as serving to regulate metabolic activity of an organ or tissue.

**endorphins** 67-69, 158, 172

**endorphins**, are neurotransmitters found in the brain that have pain-relieving properties similar to morphine. There are three major types of endorphins: beta endorphins, found primarily in the pituitary gland; and enkephalins and dynorphin, both distributed throughout the nervous system. Endorphins interact with opiate receptor neurons to reduce the intensity of pain: among individuals afflicted with chronic pain disorders, endorphins are often found in high numbers. Many painkilling drugs, such as morphine and codeine, act like endorphins and actually activate opiate receptors. Besides behaving as a pain regulator, endorphins are also thought to be connected to physiological processes including euphoric feelings, appetite modulation, and the release of sex hormones. Prolonged, continuous exercise contributes to an increased production and release of endorphins, resulting in a sense of euphoria that has been popularly labeled “runner’s high.”


**enduring media**
The expression “**enduring media**” is used by continuing education organizations and used in the book to denote the training in the science that continues on long after the live glycomics conferences because the faculty was recorded and reproduced on DVD.
energy 24, 45, 53-54, 62, 101, 107, 113, 122, 132, 133, 148, 152
In physics, energy means "active, working". The different forms of energy include kinetic, potential, thermal, electrical, chemical, nuclear, and mass energy. Energy may be transformed from one form to another, but it is never created or destroyed.

energy drain 24
In the book the term energy drain may be exchanged with fatigue.

enzyme 123, 153-154, 178-179, 205, 212-213
An enzyme is a protein (or protein-based molecule) that speeds up a chemical reaction in a living organism. An enzyme acts as a catalyst for specific chemical reactions, converting a specific set of reactants (called substrates) into specific products. Without enzymes, life as we know it would not exist.

epidemiology 217
Epidemiology is the study of the distribution of disease in populations and the study of risk and preventive factors for disease.

estradiol 213, 215
Estradiol (also oestradiol) is a sex hormone, called the "female" hormone but it is also present in males. It represents the major estrogen in humans. Estradiol has a critical impact on reproductive and sexual functioning, and also affects other organs including bone structure.

evidence 12, 80, 108, 143, 166-168, 210, 218, 227
The word evidence means to prove; to make clear to the mind; to show in such a manner that the mind can apprehend the truth. The works of creation clearly evidence the existence of an infinite first cause.

- Noah Webster 1828 American Dictionary of the English Language
Glossary

**exercise**
Regular exercise is a critical part of staying healthy. People who are active live longer and feel better. Exercise can help you maintain a healthy weight. It can delay or prevent diabetes, some cancers and heart problems. Most adults need at least 30 minutes of moderate physical activity at least five days per week. Examples include walking briskly, mowing the lawn, dancing, swimming for recreation or bicycling. Stretching and weight training can also strengthen your body and improve your fitness level. The key is to find the right exercise for you. If it is fun, you are more likely to stay motivated. You may want to walk with a friend, join a class or plan a group bike ride. If you've been inactive for awhile, use a sensible approach and start out slowly.
- Centers for Disease Control and Prevention

**familiar** 59-64, 66, 127
The word **familiar** means intimate acquaintance; to frequent converse; unconstrained intercourse.

**family** 12, 45, 54, 207, 222, 224, 227
The word **family** can denote parents and children; or everybody living in the same house; or expanded to mean tribe of people or even all of mankind.

**FAS (Fetal Alcohol Syndrome)** 19, 197-201
**Fetal Alcohol Syndrome** When a pregnant woman drinks alcohol, so does her unborn baby. There is no known safe amount of alcohol to drink while pregnant and there also does not appear to be a safe time to drink during pregnancy either. Therefore, it is recommended that women abstain from drinking alcohol at any time during pregnancy. Women who are sexually active and do not use effective birth control should also refrain from drinking because they could become pregnant and not know for several weeks or more. - National Center on Birth Defects and Developmental Disabilities

**fatigue** 188, 227
The word **fatigue** is used in everyday living to describe a range of afflictions, varying from a general state of lethargy to a specific work-induced burning sensation within one's muscles. Physiologically, "fatigue" describes the inability to continue functioning at the level of one's normal abilities due to an increased perception of effort. Fatigue is ubiquitous in everyday life, but usually becomes particularly noticeable during heavy exercise. Fatigue has two known forms; one manifests as a local, muscle-specific incapacity to do work, and the other manifests as an overall, bodily or systemic, sense of energy deprivation. Due to these two divergent facets of fatigue symptoms, it has been proposed to look at the causes of fatigue from "central" and "peripheral"
perspectives. Fatigue can be dangerous when performing tasks that require constant concentration, such as driving a vehicle. When a person is sufficiently fatigued, he or she may experience microsleeps (loss of concentration). However, objective cognitive testing should be done to differentiate the neurocognitive deficits of brain disease from those attributable to tiredness. - From Wikipedia, the free encyclopedia

FDA  207, 222  
Food and Drug Administration

fetal  19, 197-201, 204  
Starting the ninth week and continuing through the ninth month of the human gestational period or until the child is born, the baby is called a fetus.  

Fetal Alcohol Syndrome (FAS)  19, 197-201  
Fetal Alcohol Syndrome When a pregnant woman drinks alcohol, so does her unborn baby. There is no known safe amount of alcohol to drink while pregnant and there also does not appear to be a safe time to drink during pregnancy either. Therefore, it is recommended that women abstain from drinking alcohol at any time during pregnancy. Women who are sexually active and do not use effective birth control should also refrain from drinking because they could become pregnant and not know for several weeks or more.  

National Center on Birth Defects and Developmental Disabilities

fibromyalgia  26  
Fibromyalgia (also called FMS) makes you feel tired and causes muscle pain and "tender points." Tender points are places on the neck, shoulders, back, hips, arms or legs that hurt when touched. People with fibromyalgia may have other symptoms, such as trouble sleeping, morning stiffness, headaches, and problems with thinking and memory, sometimes called "fibro fog." People with rheumatoid arthritis and other autoimmune diseases are particularly likely to develop fibromyalgia. There is no medical cure for fibromyalgia, but medicines can help you manage your symptoms. Getting enough sleep and exercising may also help.  

National Institute of Arthritis and Musculoskeletal and Skin Diseases
foramina
In the brain, the **interventricular foramina** (or **foramina of Monro**) are channels that connect the paired lateral ventricles with the third ventricle at the midline of the brain. As channels, they allow cerebrospinal fluid (CSF) produced in the lateral ventricles to reach the third ventricle and then the rest of the brain's ventricular system. They also contain choroid plexus, a specialized CSF-producing structure, that is continuous with that of the lateral and third ventricles.

free radicals 25, 99-104, 107, 108
Free radicals do to the cell what rust does to metal. Oxidative stress is the result of cascading electrons bouncing, then bonding randomly within the cell. These electrons bond indiscriminately, becoming electrolysis and bore holes into cells and cut into the DNA. The radically free electrons literally become chromosomal rototillers, damaging the DNA or electronically flipping switches in the DNA at random. Studies indicate that damaged cells change, i.e. they morph, with mitochondrial DNA redistribution. Free radical damage may be THE cause for mutated cells perhaps resulting in most, if not all, of today’s illnesses and deaths due to sickness.

Function is used in every quantitative science, to model relationships between all kinds of physical quantities - especially when one quantity is completely determined by another quantity.

gastroenterology 230
**Gastroenterology** is the branch of medicine where the digestive system and its disorders are studied. Etymologically it is the combination of Ancient Greek words gastros (stomach), enteron (intestine) and logos (reason). Diseases affecting gastrointestinal tract (i.e. organs from mouth to anus) are the focus of this speciality. Doctors specialising in the field are called **gastroenterologists**. Important advances are made in the last 50 years, contributing to rapid expansion of its scope.
**Glossary**

**genetic** 44, 49, 208-209, 218
Genetics is the science of heredity and variation in living organisms. Knowledge of the inheritance of characteristics has been implicitly used since prehistoric times for improving crop plants and animals through selective breeding. However, the modern science of genetics, which seeks to understand the mechanisms of inheritance, only began with the work of Gregor Mendel in the mid-1800s. Although he did not know the physical basis for heredity, Mendel observed that inheritance is fundamentally a discrete process with specific traits that are inherited in an independent manner - these basic units of inheritance are now called genes.

Following the rediscovery of Mendel's observations in the early 1900s, research in 1910s yielded the first physical understanding of inheritance — that genes are arranged linearly along large cellular structures called chromosomes. By the 1950s it was understood that the core of a chromosome was a long molecule called DNA and genes existed as linear sections within the molecule. A single strand of DNA is a chain of four types of nucleotides; hereditary information is contained within the sequence of these nucleotides. Solved by Watson and Crick in 1953, DNA's three-dimensional structure is a doublestranded helix, with the nucleotides on each strand physically matched to each other. Each strand acts as a template for synthesis of a new partner strand, providing the physical mechanism for the inheritance of information.

The sequence of nucleotides in DNA is used to produce specific sequences of amino acids, creating proteins — a correspondence known as the "genetic code". This sequence of amino acids in a protein determines how it folds into a three-dimensional structure, this structure is in turn responsible for the protein's function. Proteins are responsible for almost all functional roles in the cell. A change to DNA sequence can change a protein's structure and behavior, and this can have dramatic consequences in the cell and on the organism as a whole.

Although genetics plays a large role in determining the appearance and behavior of organisms, it is the interaction of genetics with the environment an organism experiences that determines the ultimate outcome. For example, while genes play a role in determining a person's height, the nutrition and health that person experiences in childhood also have a large effect.

- From Wikipedia, the free encyclopedia
human genome 7-8, 44, 46, 124, 212
The Human Genome Project (HGP) was one of the great feats of exploration in history - an inward voyage of discovery rather than an outward exploration of the planet or the cosmos; an international research effort to sequence and map all of the genes - together known as the genome - of members of our species, Homo sapiens. Completed in April 2003, the HGP gave us the ability to, for the first time, to read nature's complete genetic blueprint for building a human being.

genomics 7-8, 39, 124
Genomics is the study of an organism's entire genome. Investigation of single genes, their functions and roles is something very common in today's medical and biological research, and cannot be said to be genomics but rather the most typical feature of molecular biology. Genomics can be said to have appeared in the 1980s, and took off in the 1990s with the initiation of genome projects for several biological species. A major branch of genomics is still concerned with sequencing the genomes of various organisms, but the knowledge of full genomes has created the possibility for the field of functional genomics, mainly concerned with patterns of gene expression during various conditions.

ghrelin
Ghreline is a hormone that increases hunger and appetite. Ghrelin is a hormone produced by P/D1 cells lining the acer of the human stomach that stimulate appetite. Ghrelin levels increase before meals and decrease after meals. It is considered the counterpart of the hormone leptin, produced by adipose tissue, which induces satiation when present at higher levels. Ghrelin also stimulates the secretion of growth hormone from the anterior pituitary gland. In some bariatric procedures, the level of ghrelin is reduced in patients, thus causing satiation before it would normally occur. Receptors for ghrelin are expressed by neurons in the arcuate nucleus and the ventromedial hypothalamus. The ghrelin receptor is a G protein-coupled receptor, formerly known as the GHS receptor (growth hormone secretagogue receptor). Ghrelin is also made by a small population of neurons in the arcuate nucleus. Ghrelin plays a significant role in neurotrophe, particularly in the hippocampus, and is essential for cognitive adaptation to changing environments and the process of learning. Recently, ghrelin has been shown to activate the endothelial isoform of nitric oxide synthase in a pathway that depends on various kinases including Akt.
Glossary

Glial cell  37
Glial cells, commonly called neuroglia or simply glia (Greek for "glue"), are non-neuronal cells that provide support and nutrition, maintain homeostasis, form myelin, and participate in signal transmission in the nervous system. In the human brain, glia are estimated to outnumber neurons by about 10 to 1. Glial cells provide support and protection for neurons, the other main type of cell in the central nervous system. They are thus known as the "glue" of the nervous system. The four main functions of glial cells are to surround neurons and hold them in place, to supply nutrients and oxygen to neurons, to insulate one neuron from another, and to destroy pathogens and remove dead neurons.

Glucose  105, 107, 109, 160
Glucose is a monosaccharide (or simple sugar), is an important carbohydrate in biology. The cell uses it as a source of energy and metabolic intermediate. Glucose is one of the main products of photosynthesis and starts cellular respiration in both prokaryotes and eukaryotes. The name comes from the Greek word glykys, which means "sweet", plus the suffix "-ose" which denotes a carbohydrate.

Glycans  244
The term glycans refers to a polysaccharide, or oligosaccharide. Glycans may also be used to refer to the carbohydrate (sugar) portion of a glycoconjugate, such as a glycoprotein, glycolipid, or a proteoglycan. Glycans usually consist solely of O-glycosidic linkages of monosaccharides. For example, cellulose is a glycans (or more specifically a glucans) composed of beta-1,4-linked D-glucose, and chitin is a glycans composed of beta-1,4-linked N-acetyl-D-glucosamine. Glycans can be homo or heteropolymers of monosaccharide residues, and can be linear or branched.

Glycobiology  7-9, 38, 44, 218, 224
Glycobiology is the study of sugars. The science of glycobiology is relatively new with Oxford University beginning to look into the function of oligosaccharides in the 1980s. In 1985 the research group at Oxford published a paper in Nature about glycosylation. Oxford University Press in 1988 started the journal Glycobiology. Raymond Dwek, Head of the University of Oxford's Glycobiology Institute, coined the term "glycobiology" in 1988 and it was soon used in science around the world.
Glossary

**glycome** 7-8, 44, 46, 124
The human glycome is the sum total of all the simple and complex carbohydrates in humans. Human glycomics is the in depth study of the structures and functions of all the molecules present in our glycome and all the factors that affect them. Studies in glycomics (human and other [horse, dog, etc]) will impact wellness and many diseases. Possible benefits include development of new markers for wellness and new glyconutritional approaches to sustain wellness. New insights into arthritis, autoimmune diseases, cancer, cardiovascular disease, chronic neurologic disorders, genetic diseases and infectious diseases, among others, should be afforded by glycomic studies. Glycomic approaches should help to crack the sugar code of life.

- Robert K. Murray, MD, PhD

**glycomics** 2, 7-10, 18-19, 24, 32, 38, 44, 46, 80, 124
Glycomics is the study of applied biology and chemistry that deals with the structure and function of carbohydrates (sugars). The term glycomics is derived from the chemical prefix for sweetness or a sugar, ‘glyco’, and was formed to follow the naming convention established by genomics (which deal with genes) and proteomics (which deals with proteins).”

- quote from the Institute for Glycomics at Griffith University

**glyconutrient** 25, 45, 52, 57, 63, 68-69, 75, 80, 86, 91, 97, 104, 108, 114, 118, 128
The word glyconutrient was coined by the company Mannatech around 1996 and has become a generic definition for any sugar that is a nutrient and will nourish the cells. Eight specific sugars are reported by Harper’s Biochemistry to be the building blocks for glycoproteins: Xylose, Fucose, Galactose, Glucose, Mannose, N-acetylgalactosamine, N-acetylglicosamine, and N-acetyleneuraminic acid. New discoveries indicate that the sugar trehalose may strengthen the cell membrane through which the glycoprotein receptor site protrude. Research may support that other sugars may become qualified as glyconutrients.
Glossary

**glycoprotein** 2, 123-124, 188, 208, 217

*Glycoprotein* receptor sites reside on the surface of all healthy cells like fuzz on a peach or trees on the surface of the earth. The receptors make up the “operating system” to process the DNA and all communication of the body. Eight specific sugars are reported by Harper’s Biochemistry to be the building blocks for glycoproteins: Xylose, Fucose, Galactose, Glucose, Mannose, N-acetylgalactosa-mine, N-acetylglucosamine, and N-acetylneuraminic acid. It is these glycoprotein receptor sites and their ability to transfer data that makes the glycome project at least a thousand times more complex that the genome project.

**glycosylation**

Glycosylation is the process or result of addition of saccharides to proteins and lipids. The process is one of four principal co-translational and post-translational modification steps in the synthesis of membrane and secreted proteins and the majority of proteins synthesized in the rough ER undergo glycosylation. It is an enzyme-directed site-specific process, as opposed to the non-enzymatic chemical reaction of glycation. Two types of glycosylation exist: N-linked glycosylation to the amide nitrogen of asparagine side chains and O-linked glycosylation to the hydroxy oxygen of serine and threonine side chains.

The polysaccharide chains attached to the target proteins serve various functions. For instance, some proteins do not fold correctly unless they are glycosylated first. Also, polysaccharides linked at the amide nitrogen of asparagine in the protein confer stability on some secreted glycoproteins. Experiments have shown that glycosylation in this case is not a strict requirement for proper folding, but the unglycosylated protein degrades quickly. Glycosylation may play a role in cell-cell adhesion (a mechanism employed by cells of the immune system), as well.

There are various mechanisms for glycosylation, although all share several common features: ● Glycosylation is an enzymatic process; ● The donor molecule is an activated nucleotide sugar; ● The process is site-specific.

N-linked glycosylation is important for the folding of some of eukaryotic proteins. The N-linked glycosylation process occurs in eukaryotes and widely in archaea, but very rarely in bacteria. For N-linked oligosaccharides, a 14-sugar precursor is first added to the asparagine in the polypeptide chain of the target protein. The structure of this precursor is common to most eukaryotes, and contains 3 glucose, 9 mannose, and 2 N-acetylglucosamine molecules. A complex set of reactions attaches this branched chain to a carrier molecule called dolichol, and then it is transferred to the appropriate
Glossary

point on the polypeptide chain as it is translocated into the ER lumen.

There are two major types of N-linked saccharides: high-mannose oligosaccharides, and complex oligosaccharides. High-mannose is, in essence, just two N-acetylglucosamine with many mannose residues, often almost as many as are seen in the precursor oligosaccharides before it is attached to the protein.

Complex oligosaccharides are so named because they can contain almost any number of the other types of saccharides, including more than the original two N-acetylglucosamines.

Proteins can be glycosylated by both types of oligos on different portions of the protein. Whether an oligosaccharide is high-mannose or complex is thought to depend on its accessibility to saccharide-modifying proteins in the Golgi. If the saccharide is relatively inaccessible, it will most likely stay in its original high-mannose form. If it is accessible, then it is likely that many of the mannose residues will be cleaved off and the saccharide will be further modified by the addition of other types of group as discussed above.

The oligosaccharide chain is attached by oligosaccharyltransferase to asparagine occurring in the tripeptide sequence Asn-X-Ser or Asn-X-Thr, where X could be any amino acid except Pro. This sequence is known as a glycosylation sequon. After attachment, once the protein is correctly folded, the three glucose residues are removed from the chain and the protein is available for export from the ER. The glycoprotein thus formed is then transported to the Golgi where removal of further mannose residues may take place. However, glycosylation itself does not seem to be as necessary for correct transport targeting of the protein, as one might think. Studies involving drugs that block certain steps in glycosylation, or mutant cells deficient in a glycosylation enzyme, still produce otherwise-structurally-normal proteins that are correctly targeted, and this interference does not seem to interfere severely with the viability of the cells. Mature glycoproteins may contain a variety of oligomannose N-linked oligosaccharides containing between 5 and 9 mannose residues. Further removal of mannose residues leads to a 'core' structure containing 3 mannose, and 2 N-acetylglucosamine residues, which may then be elongated with a variety of different monosaccharides including galactose, N-acetylgalactosamine, fucose and sialic acid.
Glossary

O-linked glycosylation occurs at a later stage during protein processing, probably in the Golgi apparatus. This is the addition of N-acetyl-galactosamine to serine or threonine residues by the enzyme UDP-N-acetyl-D-galactosamine:polypeptide N-acetylgalactosaminyltransferase, followed by other carbohydrates (such as galactose and sialic acid). This process is important for certain types of proteins such as proteoglycans, which involves the addition of glycosaminoglycan chains to an initially unglycosylated "proteoglycan core protein." These additions are usually serine O-linked glycoproteins, which seem to have one of two main functions. One function involves secretion to form components of the extracellular matrix, adhering one cell to another by interactions between the large sugar complexes of proteoglycans. The other main function is to act as a component of mucosal secretions, and it is the high concentration of carbohydrates that tends to give mucus its "slimy" feel. Proteins that circulate in the blood are not normally O-glycosylated, with the exception of IgA1 and IgD (two types of antibody) and C1-inhibitor.

O-fucose is added between the second and third conserved cysteines of EGF-like repeats in the Notch protein, and possibly other substrates by GDP-fucose protein O-fucosyltransferase 1, and to Thrombospondin repeats by GDP-fucose protein O-fucosyltransferase 2. In the case of EGF-like repeats, the O-fucose may be further elongated to a tetrasaccharide by sequential addition of N-acetylglucosamine (GlcNAc), galactose, and sialic acid, and for Thrombospondin repeats, may be elongated to a disaccharide by the addition of glucose. Both of these fucosyltransferases have been localized to the endoplasmic reticulum, which is unusual for glycosyltransferases, most of which function in the Golgi apparatus.

O-glucose is added between the first and second conserved cysteines of EGF-like repeats in the Notch protein, and possibly other substrates by an unidentified O-glucosyltransferase.

O-GlcNAc is added to serines or threonines by O-GlcNAc transferase. O-GlcNAc appears to occur on serines and threonines that would otherwise be phosphorylated by serine/threonine kinases. Thus, if phosphorylation occurs, O-GlcNAc does not, and vice versa. This is an incredibly important finding because phosphorylation/dephosphorylation has become a scientific paradigm for the regulation of signaling within cells. A massive amount of cancer research is focused on phosphorylation. Ignoring the involvement of this form of glycosylation which clearly appears to act in concert with phosphorylation means that a lot of current research is missing at least half of the picture. O-GlcNAc addition and removal also appear to be key regulators of the pathways which are deregulated in diabetes mellitus. The gene encoding the
O-GlcNAc removal enzyme has been linked to non-insulin dependent diabetes mellitus. It is the terminal step in a nutrient sensing hexosamine signaling pathway.

A special form of glycosylation is the GPI anchor. This form of glycosylation functions to attach a protein to a hydrophobic lipid anchor, via a glycan chain.

A mannose sugar is added to tryptophan residues in Thrombospondin repeats. This is an unusual modification both because the sugar is linked to a carbon rather than a reactive atom like a nitrogen or oxygen and because the sugar is linked to a tryptophan residue rather than an asparagine or serine/threonine.

- From Wikipedia, the free encyclopedia

gold standard 20, 33, 62, 68, 71-76
The gold standard in the book designates the highest standard that can be attained in any area.

gout 211
Gout is a painful condition that occurs when the bodily waste product uric acid is deposited as needle-like crystals in the joints and/or soft tissues. In the joints, these uric acid crystals cause inflammatory arthritis, which in turn leads to intermittent swelling, redness, heat, pain, and stiffness in the joints. In many people, gout initially affects the joints of the big toe (a condition called podagra). But many other joints and areas around the joints can be affected in addition to or instead of the big toe. These include the insteps, ankles, heels, knees, wrists, fingers, and elbows. Chalky deposits of uric acid, also known as tophi, can appear as lumps under the skin that surrounds the joints and covers the rim of the ear. Uric acid crystals can also collect in the kidneys and cause kidney stones.

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habits 59-64
The disposition or condition of the mind or body acquired by custom or a frequent repetition of the same act.
Ideal healthcare is the caring for the health of individuals with the focus on health instead of sickness and the current focus on sickness care.

hemorrhoids 207
Hemorrhoids are painful, swollen veins in the lower portion of the rectum or anus.

heroin 67-69
Heroin is an opiate synthesized directly from the extracts of the opium poppy. Upon crossing the blood-brain barrier (BBB), which occurs soon after introduction of the drug into the bloodstream, heroin mimics the action of endorphins, creating a false sense of well-being. Frequent use has a high potential for causing addiction and may quickly lead to dangerous tolerance. Once in the brain, heroin is rapidly metabolized into morphine by removal of the acetyl groups, therefore, it is known as a prodrug. It is the morphine molecule that then binds with opioid receptors and produces the subjective effects of the heroin high. The reduced endorphin production in heroin users creates a dependence on the heroin, and the cessation of heroin results in extremely uncomfortable symptoms including pain (even in the absence of physical trauma). This set of symptoms is called withdrawal syndrome. Large doses of heroin can be fatal.

high fructose corn syrup (see HFCS)

hierarchical 27, 34, 43, 47-52
Chief ruler in relationship to rank with subordination ecclesiastical government; from chief of a sacred order.

HFCS (high fructose corn syrup)

hippocampus 15, 21, 27, 126, 127
The hippocampus, part of the limbic system, is a part of the brain located in the temporal lobe, behind the ear. Humans have two hippocampi – one in each side of the brain. The hippocampus is the part of the brain responsible for forming new memories.

homeopathic 226
Homeopathy a type of alternative medicine.
homeostasis 209
The ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its physiological processes.

honey 219-220; 233
Honey is laid down by bees as a food source. In cold weather or when food sources are scarce, bees use their stored honey as their source of energy. By contriving for the bee swarm to make its home in a hive, people have been able to semi-domesticate the insects. In the hive there are three types of bee: the single queen bee, a seasonally variable number of drone bees to fertilize new queens and some 20,000 to 40,000 worker bees. The worker bees raise larvae and collect the nectar that will become honey in the hive. They go out, collect the sugar-rich flower nectar and return to the hive. As they leave the flower, bees release Nasonov pheromones. These enable other bees to find their way to the site by smell. Honeybees also release Nasonov pheromones at the entrance to the hive, which enables returning bees to return to the proper hive. In the hive the bees use their "honey stomachs" to ingest and regurgitate the nectar a number of times until it is partially digested. It is then stored in the honeycomb. Nectar is high in both water content and natural yeasts which, unchecked, would cause the sugars in the nectar to ferment. After the final regurgitation, the honeycomb is left unsealed. Bees inside the hive fan their wings, creating a strong draft across the honeycomb which enhances evaporation of much of the water from the nectar. The reduction in water content, which raises the sugar concentration, prevents fermentation. Ripe honey, as removed from the hive by the beekeeper, has a long shelf life and will not ferment.

Honey is a mixture of sugars and other compounds. With respect to carbohydrates, honey is mainly fructose (about 38.5%) and glucose (about 31.0%). The remaining carbohydrates include maltose, sucrose, and other complex carbohydrates. In addition, honey contains several vitamins, such as vitamin B6, vitamin C, thiamin, niacin, riboflavin, and pantothenic acid. Essential minerals including calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium, and zinc as well as several different amino acids have been identified in honey. Honey also contains several compounds which function as antioxidants. Known antioxidant compounds in honey are chrysin, pinobanksin, vitamin C, catalase, and pinocembrin. Unlike most other sweeteners, honey contains small amounts of a wide array of vitamins, minerals, amino acids, and antioxidants.

- From Wikipedia, the free encyclopedia
hormonal system (endocrine system)
A **hormone** is a chemical messenger from one cell (or group of cells) to another. All multicellular organisms produce hormones (phytohormone). The function of hormones is to serve as a signal to the target cells; the action of hormones is determined by the pattern of secretion and the signal transduction of the receiving tissue. Hormones are produced by endocrine glands, but hormones are also produced by organ systems and tissue types. Endocrine hormone molecules are secreted directly into the bloodstream, while exocrine hormones (or ectohormones) are secreted directly into a duct, and from the duct they either flow into the bloodstream or they flow from cell to cell by diffusion in a process known as paracrine signalling. Hormonal regulation of some physiological activities involves a hierarchy of cell types acting on each other either to stimulate or modulate the release and action of a particular hormone. The secretion of hormones from successive levels of endocrine cells is stimulated by chemical signals originating from cells higher up the hierarchical system. The master coordinator of hormonal activity is the hypothalamus acting on input it receives from the central nervous system. Other hormone secretion occurs in response to local conditions, such as the rate of secretion of parathyroid hormone by the parathyroid cells in response to fluctuations of ionized calcium levels in extracellular fluid.

Hormonal signaling across this hierarchy involves the following: (1) **Biosynthesis** of a particular hormone in a particular tissue. (2) **Storage and secretion** of the hormone. (3) **Transport** of the hormone to the target cell(s). (4) **Recognition** of the hormone by an associated cell membrane or intracellular receptor protein. (5) **Relay and amplification** of the received hormonal signal via a signal transduction process. This then leads to a cellular response. The reaction of the target cells may then be recognized by the original hormone-producing cells, leading to a down-regulation in hormone production. This is an example of a homeostatic negative feedback loop. (6) **Degradation** of the hormone.

As can be inferred from the hierarchical diagram, hormone biosynthetic cells are typically of a specialized cell type, residing within a particular endocrine gland (e.g. the thyroid gland, ovaries or testes). Hormones may exit their cell of origin via exocytosis or another means of membrane transport. However, the hierarchical model is an over simplification of the hormonal signaling process. Typically cellular recipients of a particular hormonal signal may be one of several cell types that reside within a number of different tissues, as is the case for insulin, which triggers a diverse range of systemic physiological effects. Different tissue types may also respond differently to the same hormonal signal. Because of this, hormonal signalling is elaborate and hard to dissect.
Most hormones initiate a cellular response by initially combining with either a specific intracellular or cell membrane associated receptor protein. A cell may have several different receptors that recognize the same hormone and activate different signal transduction pathways, or alternatively different hormones and their receptors may invoke the same biochemical pathway.

For many hormones, including most protein hormones, the receptor is membrane associated and embedded in the plasma membrane at the surface of the cell. The interaction of hormone and receptor typically triggers a cascade of secondary effects within the cytoplasm of the cell, often involving phosphorylation or dephosphorylation of various other cytoplasmic proteins, changes in ion channel permeability, or increased concentrations of intracellular molecules that may act as secondary messengers (e.g. cyclic AMP). Some protein hormones also interact with intracellular receptors located in the cytoplasm or nucleus by an intracrine mechanism.

For hormones such as steroid or thyroid hormones, their receptors are located intracellularly within the cytoplasm of their target cell. In order to bind their receptors these hormones must cross the cell membrane. The combined hormone-receptor complex then moves across the nuclear membrane into the nucleus of the cell, where it binds to specific DNA sequences, effectively amplifying or suppressing the action of certain genes, and affecting protein synthesis. However, it has been shown that not all steroid receptors are located intracellularly, some are plasma membrane associated.

An important consideration, dictating the level at which cellular signal transduction pathways are activated in response to a hormonal signal is the effective concentration of hormone-receptor complexes that are formed. Hormone-receptor complex concentrations are effectively determined by three factors: (1) The number of hormone molecules available for complex formation (2) The number of receptor molecules available for complex formation and (3) The binding affinity between hormone and receptor. The number of hormone molecules available for complex formation is usually the key factor in determining the level at which signal transduction pathways are activated. The number of hormone molecules available being determined by the concentration of circulating hormone, which is in turn influenced by the level and rate at which they are secreted by biosynthetic cells. The number of receptors at the cell surface of the receiving cell can also be varied as can the affinity between the hormone and its receptor.
Most cells are capable of producing one or more molecules, which act as signaling molecules to other cells, altering their growth, function, or metabolism. The classical hormones produced by endocrine glands mentioned so far in this article are cellular products, specialized to serve as regulators at the overall organism level. However they may also exert their effects solely within the tissue in which they are produced and originally released. The rate of hormone biosynthesis and secretion is often regulated by a homeostatic negative feedback control mechanism. Such a mechanism depends on factors which influence the metabolism and excretion of hormones. Thus, higher hormone concentration alone can not trigger the negative feedback mechanism. Negative feedback must be triggered by overproduction of an "effect" of the hormone.

Hormone secretion can be stimulated and inhibited by: (1) Other hormones (stimulating- or releasing-hormones); (2) Plasma concentrations of ions or nutrients, as well as binding globulins; (3) Neurons and mental activity; (4) Environmental changes, e.g., of light or temperature. One special group of hormones is the tropic hormones that stimulate the hormone production of other endocrine glands. For example, thyroid-stimulating hormone (TSH) causes growth and increased activity of another endocrine gland, the thyroid, which increases output of thyroid hormones. In order to release active hormones quickly into the circulation, hormone biosynthetic cells may produce and store biologically inactive hormones in the form of pre- or prohormones. These can then be quickly converted into their active hormone form in response to a particular stimulus.

Hormone effects vary widely, but can include: • stimulation or inhibition of growth, • induction or suppression of apoptosis (programmed cell death) • activation or inhibition of the immune system • regulating metabolism • preparation for a new activity (e.g., fighting, fleeing, mating) • preparation for a new phase of life (e.g., puberty, caring for offspring, menopause) • controlling the reproductive cycle.

In many cases, one hormone may regulate the production and release of other hormones. Many of the responses to hormone signals can be described as serving to regulate metabolic activity of an organ or tissue.

**hospital** 114, 184, 186-187, 194, 201, 216-217, 227
A sickness care facility.
humor 41, 44, 171-175, 181
Humor is the ability or quality of people, objects, or situations to evoke feelings of amusement in other people. The term encompasses a form of entertainment or human communication which evokes such feelings, or which makes people laugh or feel happy. The origin of the term is said to be derived from the humoral medicine of the ancient Greeks, which stated that a mix of fluids known as humours, literally: juice or sap, metaphorically: (flavour) helped control human health and emotion.

Huntington 10, 208-209
Huntington's disease (HD) results from genetically programmed degeneration of brain cells, called neurons, in certain areas of the brain. This degeneration causes uncontrolled movements, loss of intellectual faculties, and emotional disturbance. HD is a familial disease, passed from parent to child through a mutation in the normal gene. Each child of an HD parent has a 50-50 chance of inheriting the HD gene. If a child does not inherit the HD gene, he or she will not develop the disease and cannot pass it to subsequent generations. A person who inherits the HD gene will sooner or later develop the disease. Whether one child inherits the gene has no bearing on whether others will or will not inherit the gene. Some early symptoms of HD are mood swings, depression, irritability or trouble driving, learning new things, remembering a fact, or making a decision. As the disease progresses, concentration on intellectual tasks becomes increasingly difficult and the patient may have difficulty feeding himself or herself and swallowing. The rate of disease progression and the age of onset vary from person to person. A genetic test, coupled with a complete medical history and neurological and laboratory tests, helps physicians diagnose HD. Presymptomic testing is available for individuals who are at risk for carrying the HD gene. In 1 to 3 percent of individuals with HD, no family history of HD can be found.

National Institute of Neurological Disorders and Stroke National Institutes of Health
hydrogen

Hydrogen is a chemical element represented by the symbol $\text{H}$ and an atomic number of 1. At standard temperature and pressure it is a colorless, odorless, nonmetallic, tasteless, highly flammable diatomic gas ($\text{H}_2$). With an atomic mass of 1.00794 g/mol, hydrogen is the lightest element. Hydrogen is the most abundant of the chemical elements, constituting roughly 75% of the universe's elemental mass. Stars in the main sequence are mainly composed of hydrogen in its plasma state. Elemental hydrogen is relatively rare on Earth, and is industrially produced from hydrocarbons such as methane, after which most elemental hydrogen is used "captive"ly (meaning locally at the production site), with the largest markets about equally divided between fossil fuel upgrading (e.g., hydrocracking) and in ammonia production (mostly for the fertilizer market). Hydrogen may be produced from water using the process of electrolysis, but this process is presently significantly more expensive commercially than hydrogen production from natural gas. The most common naturally occurring isotope of hydrogen, known as protium, has a single proton and no neutrons. In ionic compounds it can take on either a positive charge (becoming a cation composed of a bare proton) or a negative charge (becoming an anion known as a hydride). Hydrogen can form compounds with most elements and is present in water and most organic compounds. It plays a particularly important role in acid-base chemistry, in which many reactions involve the exchange of protons between soluble molecules. As the only neutral atom for which the Schrödinger equation can be solved analytically, study of the energetics and bonding of the hydrogen atom has played a key role in the development of quantum mechanics.

hyper-responders 17

The term hyper-responders used in the book denotes over, above, or beyond the normal or mean average of a study. Hyper- denotes the opposite of hypo-responder. In the book we also denote non-responders in the pilot surveys as the opposite of hyper-responders.

hypoglycemia 205

Hypoglycemia is a medical term referring to a pathologic state produced by a lower than normal level of glucose (sugar) in the blood.

hypothalmic

See hypothalamus. Secretion of hormones from the anterior pituitary is under strict control by hypothalamic hormones. It has been reported that a new human hypothalmic receptor has been identified.
hypothalamus
The hypothalamus is a region of the brain that controls an immense number of bodily functions. It is located in the middle of the base of the brain, and encapsulates the ventral portion of the third ventricle. The pituitary gland, also known as the hypophysis, is a roundish organ that lies immediately beneath the hypothalamus, resting in a depression of the base of the skull called the sella turcica ("Turkish saddle"). In an adult human or sheep, the pituitary is roughly the size and shape of a garbonzo bean. Secretion of hormones from the anterior pituitary is under strict control by hypothalamichormones. It has been reported that a new human hypothalmic receptor has been identified.

hypotheses
A hypothesis consists either of a suggested explanation for a phenomenon or of a reasoned proposal suggesting a possible correlation between multiple phenomena. The term derives from the Greek, hypotithenai meaning "to put under" or "to suppose." The scientific method requires that one can test a scientific hypothesis. Scientists generally base such hypotheses on previous observations or on extensions of scientific theories.

IgE (immunoglobulin)
See immunoglobulin

immune (system; modulation)
An immune system is a collection of mechanisms within an organism that protects against infection by identifying and killing pathogens and tumor cells. It detects a wide variety of pathogens, such as viruses and parasitic worms and distinguishes them from the organism's normal cells and tissues. Detection is complicated as pathogens adapt and evolve new ways to successfully infect the host organism. To survive this challenge, several mechanisms have evolved that recognize and neutralize pathogens. Even simple unicellular organisms such as bacteria possess enzyme systems that protect against viral infections. Other basic immune mechanisms evolved in ancient eukaryotes and remain in their modern descendants, such as plants, fish, reptiles, and insects. These mechanisms include antimicrobial peptides called defensins, pattern recognition receptors, and the complement system. More sophisticated mechanisms, however, developed relatively recently, with the evolution of vertebrates. The immune systems of vertebrates such as humans consist of many types of proteins, cells, organs, and tissues, which interact in an elaborate and dynamic network. As part of this more complex immune response, the vertebrate system adapts over time to recognize particular pathogens more efficiently. The adaptation process creates immunological
memories and allows even more effective protection during future encounters with these pathogens. Disorders in the immune system can cause disease. Immunodeficiency diseases occur when the immune system is less active than normal, resulting in recurring and life-threatening infections. Immunodeficiency can either be the result of a genetic disease, such as severe combined immunodeficiency, or be produced by pharmaceuticals or an infection. In contrast, autoimmune diseases result from a hyperactive immune system attacking normal tissues as if they were foreign organisms. Common autoimmune diseases include rheumatoid arthritis, diabetes mellitus type 1 and lupus erythematosus. These critical roles of immunology in health and disease are areas of intense scientific study. A modulated immune system is vital for a healthy life.

**immunoglobulin (IgE)**
Immunoglobulin A class of immunoglobulins that includes the antibodies elicited by an allergic substance (allergen). A person who has an allergy usually has elevated blood levels of IgE. IgE antibodies attack and engage the invading army of allergens.

**immunology**
Immunology is a broad branch of biomedical science that covers the study of all aspects of the immune system in all organisms. It deals with, among other things, the physiological functioning of the immune system in states of both health and disease; malfunctions of the immune system in immunological disorders (autoimmune diseases, hypersensitivities, immune deficiency, allograft rejection); the physical, chemical and physiological characteristics of the components of the immune system in vitro, in situ, and in vivo. Immunology has various applications in several disciplines of science, and as such is further divided.

**incubator factor** 56, 85
The word incubator and incubator factor denotes a condition for certain things to materialize.
Glossary

**insulin** 229

**Insulin** is a hormone whose presence informs the body's cells that it is well fed, causing liver and muscle cells to take in glucose and store it in the form of glycogen, and causing fat cells to take in blood lipids and turn them into triglycerides. In addition it has several other anabolic effects throughout the body. Insulin is used medically to treat some forms of diabetes. Patients with type 1 diabetes mellitus depend on external insulin (most commonly injected subcutaneously) for their survival because of the absence of the hormone. Patients with type 2 diabetes mellitus have insulin resistance, relatively low insulin production, or both; some type 2 diabetics eventually require insulin when other medications become insufficient in controlling blood glucose levels. Insulin is a peptide hormone composed of 51 amino acid residues and has a molecular weight of 5808 Da. It is produced in the Islets of Langerhans in the pancreas. The name comes from the Latin insula for "island".

**ions** 107, 113-114, 122

An ion is an atom or group of atoms that has an electric charge. Ions with a positive charge are called cations. Ions with a negative charge are called anions. The negatively charge ions may contribute toward a higher pH while the positive ions may lower the pH.

**ionotropic**

The **Ligand-gated ion channels**, also referred to as **LGICs**, or **ionotropic receptors**, are a group of intrinsic transmembrane ion channels that are opened or closed in response to binding of a chemical messenger, as opposed to voltage-gated ion channels or stretch-activated ion channels. The ion channel is regulated by a ligand and is usually very selective to one or more ions like Na\(^+\), K\(^+\), Ca\(^{2+}\), or Cl\(^-\). Such receptors located at synapses convert the chemical signal of presynaptically released neurotransmitter directly and very quickly into a postsynaptic electrical signal. Many LGICs are additionally modulated by allosteric ligands, by channel blockers, ions, or the membrane potential. The prototypic ligand-gated ion channel is the nicotinic acetylcholine receptor. It consists of a pentamer of protein subunits, with two binding sites for acetylcholine, which, when bound, alter the receptor's configuration and cause an internal pore to open. This pore, permeable to Na\(^+\), allows Na\(^+\) ions to flow down their electrochemical gradient into the cell. With a sufficient number of channels opening at once, the intracellular Na\(^+\) concentration rises to the point at which the positive charge within the cell is enough to depolarize the membrane, and an action potential is initiated. Many important ion channels are ligand-gated, and they show a great degree of homology at the genetic level. The Ligand-gated ion channels are classified into three different catagories: (1) The Cys-loop receptors including anionic
and cationic; (2) glutamate receptors; and (3) The ATP-gated channels.
Information on ionotrop[ic is open for review

**IQ 168**
An *intelligence quotient* or IQ is a score derived from one of several different standardized tests attempting to measure intelligence. IQ tests are used as predictors of educational achievement.

*Any person disagreeing with the author’s statement below is welcome to respond with documented evidence. Especially welcome are copies of test results that vary for the same individuals for different years.:*

No one has yet developed a perfect IQ system of comparing any two IQ scores from different IQ test results. Comparison of the test results, regardless of how high or how low they may be, cannot determine what a good IQ score really is. Part of the challenge in determining a good IQ score is knowing what level of test was used. Your score will go up or down, depending on the difficulty level in different parts of the test. The writers of the different IQ tests vary the questions by age, education and other factors. Different IQ tests can give you the same score but the contents of the questions in different tests are different even though the name of these tests may appear the same. General IQ tests are developed from all categories of intelligence but today’s specialization compounds the accuracy of any IQ test. IQ tests seem rather useless to a savant which may receive a very low score, yet be brilliant in specific areas. If you are in school, learning each year, and taking an IQ test each year, you will most likely get a different result each year. Perhaps, another factor should be used to adjust the final score of an IQ test like: How many times each day do you get angry at an inanimate object?

**IQ Answers**

IQ Answer to Question in Chapter 14: Most people participating in this math game calculate the answer to be 5,000. Now, do the math. The correct answer is 4,100.

IQ Answer to Question at end of Chapter 31: Open the drain.

**junk food/thought** 9, 75, 86, 102

**Junk food or thought** has little or no substance or nourishment for body or mind.

**Krebiozen** 193

An alternative cancer treatment. Story in the book relates to a placebo “cure”.

324
Glossary

**L-ascorbic acid**  
*Ascorbic acid* is an organic acid with antioxidant properties. Its appearance is white to light yellow crystals or powder. It is water soluble. The L-enantiomer of ascorbic acid is commonly known as vitamin C. The name is derived from α- and scorbuticus (Scurvy) as a shortage of this molecule may lead to scurvy. In 1937 the Nobel Prize for chemistry was awarded to Walter Haworth for his work in determining the structure of ascorbic acid (shared with Paul Karrer, who received his award for work on vitamins), and the prize for Physiology or Medicine that year went to Albert Szent-Györgyi for his studies of the biological functions of L-ascorbic acid. At the time of its discovery in the 1920s it was called *hexuronic acid* by some researchers.

**L-gluconogammalactone**  
Humans are unable to synthesize L-ascorbic acid (vitamin C); therefore, they require it in their diet. The enzyme, L-gluconolactone oxidase, which usually would catalyze the conversion of L-gluconogammalactone to L-ascorbic acid, is defective due to a mutation or inborn error in carbohydrate metabolism.

**L-gluconolactone**  
The enzyme, L-gluconolactone oxidase, which usually would catalyze the conversion of L-gluconogammalactone to L-ascorbic acid, is defective due to a mutation or inborn error in carbohydrate metabolism.

**Laryngeal cancer**  
216  
Cancer of the larynx can develop in any part of the larynx, but most begins in the glottis. The inner walls of the larynx are lined with cells called squamous cells. Almost all laryngeal cancers begin in these cells.

**Law**  
48, 148, 198, 226  
Legal rules to be followed.
Glossary

lemon 45, 96, 98, 118
Lemons contain vitamins and minerals that are beneficial to the health. A terpene called D-limonene produces their characteristic lemon smell and taste. They contain Vitamin C which is essential for human health. 100 milliliters of lemon juice contains approximately 50 milligrams of Vitamin C (55% of the recommended daily value). Some sources state that lemons contain unique flavonoid compounds that have antioxidant and anti-cancer properties. These may be able to deter cell growth in cancers. Limonins found in lemons could also be anticarcinogens. Lemons have been touted in alternative medicine as a tonic for the digestive system and immune system. There is a belief in Ayurvedic medicine that a cup of hot water with lemon juice in it tonifies and purifies the liver. In a Japanese study into the effects of aromatherapy, lemon essential oil in vapour form has been found to reduce stress in mice.

leptin 229
Leptin (from the Greek word leptos, meaning thin) is a 16 kDa protein hormone that plays a key role in regulating energy intake and energy expenditure, including the regulation (decrease) of appetite and (increase) of metabolism. The effects of leptin were observed by studying mutant obese mice that arose at random within a mouse colony at the Jackson Laboratory in 1950. These mice were massively obese and hyperphagic. Leptin itself was discovered in 1994 by Jeffrey M. Friedman and colleagues at the Rockefeller University through the study of those mutant mice. The Ob(Lep) gene (Ob for obese and Lep for leptin) is located on chromosome 7 in humans. Leptin is produced by adipose tissue and interacts with six types of receptor (LepRa–LepRf). LepRb is the only receptor isoform that contains active intracellular signaling domains. This receptor is present in a number of hypothalamic nuclei, where it exerts its effects. Importantly, leptin binds to the Ventral Medial nucleus of the hypothalamus, known as the "satiety center." Binding of leptin to this nucleus signals to the brain that the body has had enough to eat -- a sensation of satiety. A very small group of humans possess homozygous mutations for the leptin gene which lead to a constant demand for food, resulting in severe obesity. This condition can be successfully treated by the administration of recombinant human leptin.
Thus, circulating leptin levels give the brain a reading of energy storage for the purposes of regulating appetite and metabolism. Leptin works by inhibiting the activity of neurons that contain neuropeptide Y (NPY) and agouti-related peptide (AgRP), and by increasing the activity of neurons expressing αa-melanocyte-stimulating hormone (αa-MSH). The NPY neurons are a key element in the regulation of appetite; small doses of NPY injected into the brains of experimental animals stimulates feeding, while selective destruction of the NPY neurons in mice causes them to become anorexic. Conversely, αa-MSH is an important mediator of satiety, and differences in the gene for the receptor at which αa-MSH acts in the brain are linked to obesity in humans. Leptin is also regulated (downward) by melatonin during the night.

**ligands**  157

**Ligands** are manufactured by nerve cells, immune cells, and other cells that play a role in the development, function, maintenance, and operations of synapses, neurons, and other organs. The 200 ligand alphabet forms "words" of instruction for different behaviors. I will not attempt to cover the magnitude of how the ligands control the neurotransmitters through excitation, activation, and inhibition. The function of the ligands helps us better understand the role of electrolyte and micro-nutrients discussed in earlier chapters. (The word "ligands" is from Latin meaning, "to tie or bind"). The ions or molecules that bind to transition-metal ions form these more complex ions that make up the coordination numbers. This complex electrochemical language controls the neurotransmitters that control your mind and body.

**lipid**  116, 213-215, 223

**Lipids** can be broadly defined as any fat-soluble naturally-occurring molecules. The term is more-specifically used to refer to fatty-acids and their derivatives including tri-, di-, and monoglycerides and phospholipids, as well as other fat-soluble sterol-containing metabolites such as cholesterol. Lipids serve many functions in living organisms including energy storage, serve as structural components of cell membranes, and constitute important signaling molecules.

**lipoproteins**  205, 209, 211, 218.

A **lipoprotein** is a biochemical assembly that contains both proteins and lipids. The lipids or their derivatives may be covalently or non-covalently bound to the proteins. Many enzymes, transporters, structural proteins, antigens, adhesins and toxins are lipoproteins. Examples include the high density and low density lipoproteins of the blood, the transmembrane proteins of the mitochondrion and the chloroplast, and bacterial lipoproteins.
**Glossary**

**lysosomal**

**Lysosomes** are organelles that contain digestive enzymes (acid hydrolases). They digest excess or worn out organelles, food particles, and engulfed viruses or bacteria. The membrane surrounding a lysosome prevents the digestive enzymes inside from destroying the cell. Lysosomes fuse with vacuoles and dispense their enzymes into the vacuoles, digesting their contents. They are built in the Golgi apparatus. The name lysosome derives from the Greek words lysis, which means dissolution or destruction, and soma, which means body. They are frequently nicknamed "suicide-bags" or "suicide-sacs" by cell biologists due to their role in autolysis. Lysosomes were discovered by the Belgian cytologist Christian de Duve in 1949.

**Magna Cum Laude** 226

*magna cum laude*, “with great honor”; direct translation: “with great praise”

**malabsorption** 205
Malabsorption is difficulty in the digestion or absorption of nutrients from food.

**marijuana** 199

**Marijuana** is the most commonly abused illicit drug in the United States. A dry, shredded green/brown mix of flowers, stems, seeds, and leaves of the hemp plant Cannabis sativa, it usually is smoked as a cigarette (joint, nail), or in a pipe (bong). It also is smoked in blunts, which are cigars that have been emptied of tobacco and refilled with marijuana, often in combination with another drug. It might also be mixed in food or brewed as a tea. As a more concentrated, resinous form it is called hashish and, as a sticky black liquid, hash oil. Marijuana smoke has a pungent and distinctive, usually sweet-and-sour odor. There are countless street terms for marijuana including pot, herb, weed, grass, widow, ganja, and hash, as well as terms derived from trademarked varieties of cannabis, such as Bubble Gum, Northern Lights, Fruity Juice, Afghani #1, and a number of Skunk varieties. The main active chemical in marijuana is THC (delta-9-tetrahydrocannabinol). The membranes of certain nerve cells in the brain contain protein receptors that bind to THC. Once securely in place, THC kicks off a series of cellular reactions that ultimately lead to the high that users experience when they smoke marijuana.

The National Institute on Drug Abuse (NIDA) is part of the National Institutes of Health (NIH)

**mathematics** 90, 131, 144, 164, 169-170
Mathematics is the body of knowledge centered on such concepts as quantity, structure, space, and change, and also the academic discipline that studies them.
Glossary

**membrane** 49, 106, 160-161, 208, 213-214
In medicine, microbiology, cellular physiology and biochemistry a **membrane** is a thin layer that separates various cellular structures or organs. It usually includes lipid bilayer reinforced by proteins and other macromolecules.

**memory storage** 12, 19, 32, 78, 122
Any device that is capable of storing memory.

**memory tracing** 42, 77-81, 84, 126
Placing one memory over another like memory. Hundreds of billions of neurons can generate virtually an unlimited multitude of unique networks of memory traces. Each trace can lead to virtually an unlimited number of experiences from all of the senses.

**mental exercise** 15, 61, 84, 86-92, 112, 134
Deliberately exercising your mind with minor to complex challenges.

**mice** 13, 17, 20, 22, 26
A small animal used in many laboratory studies.

**micro-nutrient** 17, 19-20, 80, 95-96, 157, 199-200
Micro-nutrients are nutrients needed for life in small quantities. These include phytochemicals and vitamins and minerals. Microminerals are also called trace minerals. Without micro-nutrients there is malnutrition especially in children worldwide.

**mitochondria** 9, 101, 102, 105-109, 112
The mitochondria inside the cells burn the final fuel of the body. Glucose and oxygen are the fuel. Oxygenation is vital to life while oxidation is the “rusting” or destruction of life. The mitochondria are the cells' power sources. They are distinct organelles with two membranes. Usually they are rod-shaped, however they can be round. The outer membrane limits the organelle. The inner membrane is thrown into folds or shelves that project inward. These are called "cristae mitochondriales".

**monoamines**
**Monoamine neurotransmitters** are neurotransmitters and neuromodulators that contain one amino group that is connected to an aromatic ring by a two-carbon chain (-CH₂-CH₂). All monoamines are derived from aromatic amino acids like phenylalanine, tyrosine, histidine, tryptophan, and the thyroid hormones by the action of aromatic amino acid decarboxylase enzymes.
Glossary

mother’s milk  18, 20, 200, 217-218, 260
The nourishment a baby receives from his or her lactating mother.

music  27, 137-138, 144, 164-170, 181, 199
Music is a melody or harmony of sounds modulated to please the ear.

myocardial infarction (AMI or MI)  218 #148
Acute myocardial infarction (AMI or MI), more commonly known as a heart attack, is a medical condition that occurs when the blood supply to a part of the heart is interrupted. The resulting oxygen shortage causes damage and potential death of heart tissue. The term myocardial infarction is derived from myocardium (the heart muscle) and infarction (tissue death due to oxygen starvation). The phrase "heart attack" is sometimes used incorrectly to describe sudden cardiac death, which may or may not be the result of acute myocardial infarction. Metabolic studies have clearly shown that trans fatty acids (TFAs) elevate LDL and lower HDL cholesterol. Epidemiologic studies indicate a relation between TFA intake and the risk of myocardial infarction (MI). (Different texts use both: infarcation and infarction.)

myopia  210
Myopia is "near-sightedness". Those with myopia see nearby objects clearly but distant objects appear blurred. With myopia, the eyeball is too long, or the cornea is too steep, so images are focused in the vitreous inside the eye rather than on the retina at the back of the eye. The opposite defect of myopia is hyperopia or "farsightedness" or "long-sightedness" — this is where the cornea is too flat or the eye is too short.

myelin sheath  36-40
The myelin sheath (a tubular case or envelope) gives the whitish appearance to the white matter of the brain. Myelin cells are included in the category of Glial cells. Glial cells function to support the processes of neurons in a variety of ways. The glial cells forming myelin sheaths are called oligodendrocytes in the central nervous system and Schwann cells in the peripheral nervous system.
Glossary

nanotechnology

Nanotechnology refers broadly to a field of applied science and technology whose unifying theme is the control of matter on the molecular level in scales smaller than 1 micrometre, normally 1 to 100 nanometers, and the fabrication of devices within that size range. It is a highly multidisciplinary field, drawing from fields such as applied physics, materials science, colloidal science, device physics, supramolecular chemistry, and even mechanical and electrical engineering. Much speculation exists as to what new science and technology may result from these lines of research. Nanotechnology can be seen as an extension of existing sciences into the nanoscale, or as a recasting of existing sciences using a newer, more modern term.

Two main approaches are used in nanotechnology. In the "bottom-up" approach, materials and devices are built from molecular components which assemble themselves chemically by principles of molecular recognition. In the "top-down" approach, nano-objects are constructed from larger entities without atomic-level control. The impetus for nanotechnology comes from a renewed interest in colloidal science, coupled with a new generation of analytical tools such as the atomic force microscope (AFM), and the scanning tunneling microscope (STM). Combined with refined processes such as electron beam lithography and molecular beam epitaxy, these instruments allow the deliberate manipulation of nanostructures, and led to the observation of novel phenomena.

Examples of nanotechnology in modern use are the manufacture of polymers based on molecular structure, and the design of computer chip layouts based on surface science. Despite the great promise of numerous nanotechnologies such as quantum dots and nanotubes, real commercial applications have mainly used the advantages of colloidal nanoparticles in bulk form, such as suntan lotion, cosmetics, protective coatings, and stain resistant clothing.

neural code 30, 48

Scientists are looking for and will “discover” the universal neural code. The code will help explain how memory is embedded.

neural pathways 53, 54, 84, 103, 107

Neural pathways are formed by the 100 to 10,000 synapses coming off of each neuron. With some 100 billion neurons in the brain, they increase the possibility of a more indelible impression in your memory.
Neurons are declared to be the most highly advanced and functional cell in the body. You learn, remember, make decisions, interpret, and control muscles with neurons.

neurodegenerative 36, 38
The degeneration of the neurological system.

neurological system 26
The Neurological System is the body’s information processor. Without this highly advanced information and communication system, the body cannot function.

neurology 2, 13, 26, 44, 143, 223
Neurology is a branch of medicine dealing with disorders of the nervous system. Medical professionals specializing in the field of neurology are called neurologists and are trained to diagnose, treat, and manage patients with neurological disorders. Most neurologists are trained to treat and diagnose adults with neurological disorders. Pediatric neurologists, nearly always a subspecialty of pediatrics, treat neurological disease in children. Neurologists may also be involved in clinical research, clinical trials, as well as basic research and translational research.

Neurons are declared to be the most highly advanced and functional cell in the body. You learn, remember, make decisions, interpret, and control muscles with neurons.

neurotransmitters 122, 155, 157, 178, 180-181
(The following is under review. Scientists are continually learning more about neurotransmitters.):
Neurotransmitters are chemicals that are used to relay, amplify and modulate electrical signals between a neuron and another cell. According to the prevailing beliefs of the 1960s, a chemical can be classified as a neurotransmitter if it meets the following conditions: It is synthesized endogenously, that is, within the presynaptic neuron; It is available in sufficient quantity in the presynaptic neuron to exert an effect on the postsynaptic neuron; Externally administered, it must mimic the endogenously-released substance; and A biochemical mechanism for inactivation must be present. However, there are other materials, such as the zinc ion, that are neither synthesized nor catabolized (i.e., degraded; see Anabolism) and are considered neurotransmitters by some. Thus, the old definitions are being revised. Types of neurotransmitters: There
Glossary

are many different ways to classify neurotransmitters. Often, dividing them into amino acids, peptides, and monoamines is sufficient for many purposes. Some more precise divisions are as follows: Around 10 "small-molecule neurotransmitters" are known: acetylcholine, monoamines, (norepinephrine NE, dopamine DA & serotonin 5-HT) 3 or 4 amino acids, depending on exact definition used: (primarily glutamic acid, GABA, aspartic acid & glycine) Purines, (Adenosine, ATP, GTP and their derivatives) Over 50 neuroactive peptides (vasopressin, somatostatin, neurotensin, etc.) have been found, among them hormones such as LH or insulin that have specific local actions in addition to their long-range signalling properties. Single ions, such as synaptically-released zinc, may also be considered neurotransmitters by some. The major neurotransmitters of the brain are glutamic acid (=glutamate) and GABA. Examples of neurotransmitter action:

(1) Acetylcholine - voluntary movement of the muscles; (2) Norepinephrine - wakefulness or arousal; (3) Dopamine - voluntary movement and motivation, "wanting"; (4) Serotonin - memory, emotions, wakefulness, sleep and temperature regulation; (5) GABA (gamma aminobutyric acid) - inhibition of motor neurons; (6) Glycine - spinal reflexes and motor behaviour; (7) Neuromodulators - sensory transmission-especially pain. It is important to appreciate that it is the receptor that dictates the neurotransmitter's effect. Within the cells, small-molecule neurotransmitters are usually packaged in vesicles. When an action potential reaches the cell body, the rapid depolarization causes calcium ion (Ca2) channels to open. Calcium then stimulates the transport of vesicles to the synaptic membrane and their release at synaptic boutons - a form of exocytosis. These neurotransmitters are released in quanta, whereby a single quantum consists of a vesicle containing possibly thousands of neurotransmitters (see: J. Del Castillo and B. Katz, "The effect of magnesium on the activity of motor nerve endings", 124:553-559). The neurotransmitters then diffuse across the synaptic cleft to bind to densely and geometrically arranged receptors. The receptors are broadly classified into ionotropic and metabotropic receptors. Ionotropic receptors are ligand-gated ion channels that open or close through neurotransmitter binding. Metabotropic receptors, which can have a diverse range of effects on a cell, transduct the signal by secondary messenger systems, or G-proteins. Neuroactive peptides are made in the neuron's soma and are transported through the axon to the synapse. They are usually packaged into dense-core vesicles and are released through a similar, but metabolically distinct, form of exocytosis used for small-molecule synaptic vesicles. A neurotransmitter's effect is determined by its receptor. For example, GABA can act on both rapid or slow inhibitory receptors (the GABA-A and GABA-B receptor respectively). Many other neurotransmitters, however, may have excitatory or inhibitory actions depending on which receptor they bind to. Neurotransmitters may cause either excitatory or inhibitory post-synaptic potentials. That is, they may help the initiation of a nerve impulse in the receiving neuron, or they may discourage such an impulse by
modifying the local membrane voltage potential. In the central nervous system, combined input from several synapses is usually required to trigger an action potential. Glutamate is the most prominent of excitatory transmitters; GABA and glycine are well-known inhibitory neurotransmitters. Many neurotransmitters are removed from the synaptic cleft by neurotransmitter transporters in a process called reuptake (or often simply 'uptake'). Without reuptake, the molecules might continue to stimulate or inhibit the firing of the postsynaptic neuron. Another mechanism for removal of a neurotransmitter is digestion by an enzyme. For example, at cholinergic synapses (where acetylcholine is the neurotransmitter), the enzyme acetylcholinesterase breaks down the acetylcholine. Neuroactive peptides are often removed from the cleft by diffusion, and eventually broken down by proteases. While some neurotransmitters (glutamate, GABA, glycine) are used very generally throughout the central nervous system, others can have more specific effects, such as on the autonomic nervous system, by both pathways in the sympathetic nervous system and the parasympathetic nervous system, and the action of others are regulated by distinct classes of nerve clusters which can be arranged in familiar pathways around the brain. For example, Serotonin is released specifically by cells in the brainstem, in an area called the raphe nuclei, but travels around the brain along the medial forebrain bundle activating the cortex, hippocampus, thalamus, hypothalamus and cerebellum. Also, it is released in the Caudal serotonin nuclei, so as to have effect on the spinal cord. In the peripheral nervous system (such as in the gut wall) serotonin regulates vascular tone. Dopamine classically modulates two systems: the brain's reward mechanism, and movement control. Neurotransmitters that have these types of specific actions are often targeted by drugs. Cocaine, for example, blocks the reuptake of dopamine, leaving these neurotransmitters in the synaptic gap longer. Prozac is a selective serotonin reuptake inhibitor (SSRI), hence potentiating the effect of naturally released serotonin. AMPT prevents the conversion of tyrosine to L-DOPA, the precursor to dopamine; reserpine prevents dopamine storage within vesicles; and deprenyl inhibits monoamine oxidase (MAO)-B and thus increases dopamine levels. Some neurotransmitter/neuromodulators like zinc not only can modulate the sensitivity of a receptor to other neurotransmitters (allosteric modulation) but can even penetrate specific, gated channels in post-synaptic neurons, thus entering the post-synaptic cells. This "translocation" is another mechanism by which synaptic transmitters can affect postsynaptic cells. Diseases may affect specific neurotransmitter pathways. For example, Parkinson's disease is at least in part related to failure of dopaminergic cells in deep-brain nuclei, for example the substantia nigra.

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n
Glossary

nitrogen
Nitrogen is a chemical element which has the symbol N and atomic number 7. Elemental nitrogen is a colourless, odourless, tasteless and mostly inert diatomic gas at standard conditions, constituting 78.1% by volume of Earth's atmosphere. Nitrogen is a constituent element of all living tissues and amino acids.

nodes
A point in a network at which lines intersect or branch; in anatomy, a small mass of distinct tissue.

noise
Sound of any kind; strife, squabble, dispute, to disturb.

norepinephrine
norepinephrine is a neurotransmitter in the catecholamine family that mediates chemical communication in the sympathetic nervous system, a branch of the autonomic nervous system. Like other neurotransmitters, it is released at synaptic nerve endings to transmit the signal from a nerve cell to other cells. Norepinephrine is almost identical in structure to epinephrine, which is released into the bloodstream from the adrenal medulla under sympathetic activation. The sympathetic nervous system functions in response to short-term stress; hence norepinephrine and epinephrine increase the heart rate as well as blood pressure. Other actions of norepinephrine include increased glycogenolysis (the conversion of glycogen to glucose) in the liver, increased lipolysis (the conversion of fats to fatty acids; in adipose (fat) tissue, and relaxation of bronchial smooth muscle to open up the air passages to the lungs. All of these actions represent a mobilization of the body's resources in order to meet the stressful challenge—such a response is often termed the "flight or fight" syndrome.


nonylphenol
Nonylphenol is an organic compound of the wider family of alkylphenols. It is a product of industrial synthesis formed during the alkylation process of phenols, particularly in the synthesis of polyethoxylate detergents. Because of their man-made origins, nonylphenols are classified as xenobiotics. In nonylphenols, a hydrocarbon chain of nine carbon atoms is attached to the phenol ring in either the ortho (2), meta (3), or para (4) position, with the most common ring isomers being ortho or para (e.g. figure 1 para-nonylphenol). Moreover, the alkyl chains can exist as either linear n-alkyl chains, or complex branched chains. Nonylphenol is commonly obtained as a mixture of isomers, and is thus usually found as a pale yellow liquid at room temperature with a
melting point of -10°C and a boiling point of 295-320°C. However, pure isomers of nonylphenol crystallize readily at room temperatures and for example, para-n-nonylphenol, forms white crystals at room temperature. Ethoxylated alkylphenols, alkylphenol ethoxylates (APE), are used as industrial surfactants in manufacture of wool and metal, as emulsifiers for emulsion polymerization, in laboratory detergents, and pesticides. APEs are a component of some household detergents outside of Europe; within Europe, due to environmental concerns, they are replaced by more expensive but safer alcohol ethoxylates. Nonoxynol-9, one of the APEs, is used as a surfactant in cleaning and cosmetic products, and as a spermicide in contraceptives. Nonylphenol, and a related compound tert-octylphenol, were first detected as an air pollutant in New York City and New Jersey, probably due to its evaporation from the Hudson river and other smaller rivers in the region that routinely receive municipal wastewaters. It is possible that the atmosphere is a destructive sink for nonylphenol as it is probably reactive with atmospheric radicals and/or is photoactive. Nonylphenol and nonylphenol ethoxylates have been banned in the European Union as a hazard to human and environmental safety. Biochemically, p-nonylphenol and many of its derivatives act as a xenoestrogen.

- From Wikipedia, the free encyclopedia

**nurses** 10, 186

A nurse is a healthcare professional who is engaged in the practice of nursing. Nurses are responsible - along with other healthcare professionals - for the treatment, safety, and recovery of acutely or chronically ill or injured people, health maintenance of the healthy, and treatment of life-threatening emergencies in a wide range of health care settings. Nurses may also be involved in medical and nursing research and perform a wide range of non-clinical functions necessary to the delivery of health care.

**nutraceutical** 226

The term nutraceutical was coined in the 1990's by Dr. Stephen DeFelice. He defined nutraceutical as: 'A nutraceutical is any substance that is a food or a part of a food and provides medical or health benefits, including the prevention and treatment of disease. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered designer foods, herbal products, and processed foods such as cereals, soups and beverages. It is important to note that this definition applies to all categories of food and parts of food, ranging from dietary supplements such as folic acid, used for the prevention of spina bifida, to chicken soup, taken to lessen the discomfort of the common cold. This definition also includes a bio-engineered designer vegetable food, rich in antioxidant ingredients, and a stimulant functional food or pharmafood.' Since the term was coined, its meaning has been
modified. Health Canada defines nutraceutical as: 'a product isolated or purified from foods, and generally sold in medicinal forms not usually associated with food and demonstrated to have a physiological benefit or provide protection against chronic disease.'

**nutrition** 10, 12-13, 15, 17, 24, 33, 75, 80, 86, 88, 121  
**Nutrition** is a science that examines the relationship between diet and health. Dietitians are health professionals who specialize in this area of study, and are trained to provide safe, evidence-based dietary advice and interventions. Deficiencies, excesses and imbalances in diet can produce negative impacts on health, which may lead to diseases such as cardiovascular disease, diabetes, scurvy, obesity or osteoporosis, as well as psychological and behavioral problems. Many common diseases and their symptoms can often be prevented or alleviated with better nutrition. The science of nutrition attempts to understand how and why specific dietary aspects influence health.

**oligodendrocytes**

**Oligodendrocytes** (from Greek literally meaning few tree cells), or **oligodendroglia** (Greek, few tree glue), are a variety of neuroglia. Their main function is the myelination of axons exclusively in the central nervous system, a function performed by Schwann cells in the peripheral nervous system. A single oligodendrocyte can extend to up to 50 axons, wrapping around approximately 1 mm of each and forming the myelin sheath.

**oligopeptides** 124  
See peptides. An **oligopeptide** (oligo-, “few”) consists of a small number of amino acids linked together, as opposed to a polypeptide (poly-, “many”).

**oncology** 242-243  
**Oncology** is the field of medicine that deals with the therapy of cancer.

**Open-label Pilot Survey** 13  
A Pilot Survey where the subject know what they are using in the survey. A Pilot Survey is often conducted prior to clinical trials.
Optimal Propensity System
Putting into effect an integrative system of individual means of improving positive propensity toward achieving desired results. The word \textit{propensity} in \textit{Noah Webster’s 1828 Dictionary} says: Bent of mind, natural or acquired; inclination; in a moral sense; disposition to any thing good or evil, particularly to evil; as a \textit{propensity} to sin; the corrupt \textit{propensity} of the will.

\textbf{ORAC (Oxygen Radical Absorption Capacity) and ORACo} 104
\textbf{ORAC} methods for assessing the antioxidant potential of samples are fluorescence-based ORAC methods, do not allow lipid- and water-soluble samples to be tested at the same time. The ORACfl method is appropriate for assaying the antioxidant capacity of water-soluble samples. The ORACfl-lipo method was designed to assay lipid-soluble samples but often does not take into account water-soluble elements. These currently used methods also involve an initial extraction that reduces or excludes less soluble (but perhaps functionally important) parts of a sample. At best, lipid- and watersoluble portions of samples are separated and analyzed individually, but this separation prevents analysis of meaningful interactions. Since antioxidants in the body often work in concert and include both lipid- and water-soluble compounds, an assay that allows both types of antioxidants to interact (potentially cooperating or interfering with each other) would provide a more accurate model of antioxidant activity in humans. The ORACo method, which uses an oxygen-specific probe, was created to address problems with current industry standards. Because of its unique solvent system and sample preparation technique, the ORACo method, which simultaneously measures the activities of lipid- and watersoluble compounds, allows the detection of interactions that cannot be measured through the use of fluorescence-based antioxidant assays.

\textbf{organelle} 106
\textbf{Organelle} is one of the specialized parts of a protozoan or tissue cell; these subcellular units include mitochondria, the Golgi apparatus, nucleus and centrioles, granular and agranular endoplasmic reticulum, vacuoles, microsomes, lysosomes, plasma membrane, and certain fibrils, as well as plastids of plant cells.

\textit{Stedman’s Medical Dictionary, 28th Edition}
osteoporosis  207
Osteoporosis is weak bone density that makes your bones more brittle and more likely to break. Anyone can develop osteoporosis, but it is common in older people. An estimate that as many as half of all women and a quarter of men older than 50 will break a bone due to osteoporosis. The risk factors include (1) Getting older; (2) Being small and thin; (3) Having a family history of osteoporosis; (4) Taking certain medicines that make the bond density less; (5) Being a white or Asian woman; (6) Having osteopenia, which is low bone mass. Osteoporosis is a silent disease. You might not know you have it until you break a bone. A whole body Dexa-Scan is a detail measurement of bone density. To keep bones strong, eat a diet rich in calcium and vitamin D, exercise and do not smoke. It is believe by many medical experts that bone density loss cannot be reversed. Osteoporosis is one of the bio-markers of aging and the author has experienced increased bone density in a fairly large number of people who have participated in a longitudinal study.

oxidation  102, 105, 111-114
Oxidation describes the loss of electrons by a molecule, atom or ion that causes “rusting” or aging.

oxygen  15, 101, 104-105, 107-108, 111-114, 159
Oxygen is the most common component of the Earth's crust (49% by mass), the second most common component of the Earth as a whole (28% by mass), the most common component of the world's oceans (86% by mass), and the second most common component of the Earth's atmosphere (20.947% by volume), second to nitrogen. Elemental oxygen occurs not only in the atmosphere, but also as solution in the world's water bodies.

oxygenation  15, 105, 111-114
Oxygenation refers to the amount of oxygen in a medium. In blood it may be taken to be synonymous with saturation, which describes the degree to which the oxygen-carrying capacity of haemoglobin is utilized, normally 98-100%. Oxygenation also refers to the process of adding oxygen to a medium such as water or body tissue. Claims have been made that oxygenation of human tissue prevent diseases, including cancer, however some regard these claims as unverifiable. Oxygenation of various fluorocarbon liquids has been used successfully in liquid breathing systems, allowing air-breathing animals, including humans, to breathe via liquids for short periods of time.
pain  73, 128, 172, 185, 187-188
Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" - International Association for the Study of Pain (IASP). Scientifically, pain (a subjective experience) is separate and distinct from nociception, the system which carries information, about inflammation, damage or near-damage in tissue, to the spinal cord and brain. Nociception frequently occurs without pain being felt and is below the level of consciousness. Despite it triggering pain and suffering, nociception is a critical component of the body's defense system. It is part of a rapid-warning relay instructing the central nervous system to initiate motor neurons in order to minimize detected physical harm. Pain too is part of the body's defense system; it triggers mental problem-solving strategies that seek to end the painful experience, and it promotes learning, making repetition of the painful situation less likely. The two most common forms of pain reported in the United States are headache and back pain.

pancreas  230
The pancreas is a gland organ in the digestive and endocrine systems. It is both exocrine (secreting pancreatic juice containing digestive enzymes) and endocrine (producing several important hormones, including insulin, glucagon, and somatostatin). It is considered to be the most important intestinal gland.

paracelluar
Paracellular transport refers to the transfer of substances between cells. It is in contrast to "transcellular transport", where the substances travel through the cell, passing through both the apical membrane and basolateral membrane. The distinction is in particular significance in renal physiology. Transcellular transport is more likely to involve energy expenditure than paracellular transport. Capillaries of the Blood Brain Barrier (BBB) have transcellular transport only in contrast with normal capillaries which have both - transcellular and paracellular transport. This is due to the presence of tight junctions in the BBB and Astrocytes that surround the capillaries.
Glossary

**Parkinson** 10, 136, 209, 235

**Parkinson's disease** is a disorder that affects nerve cells, or neurons, in a part of the brain that controls muscle movement. In Parkinson's, neurons that make a chemical called dopamine die or do not work properly. Dopamine normally sends signals that help coordinate your movements. No one knows what damages these cells. Symptoms of Parkinson's disease may include ● Trembling of hands, arms, legs, jaw and face ● Stiffness of the arms, legs and trunk ● Slowness of movement ● Poor balance and coordination. As symptoms get worse, people with the disease may have trouble walking, talking or doing simple tasks. They may also have problems such as depression, sleep problems or trouble chewing, swallowing or speaking. Parkinson's usually begins around age 60, but it can start earlier. It is more common in men than in women. (NIH reports there no cure for Parkinson's disease.)


**pathology** 209, 216, 219

**Pathology** is the study and diagnosis of disease through examination of organs, tissues, cells and bodily fluids. The term encompasses both the medical specialty which uses tissues and body fluids to obtain clinically useful information, as well as the related scientific study of disease processes. The histories of both experimental and medical pathology can be traced to the earliest application of the scientific method to the field of medicine, a development which occurred in Western Europe during the Italian Renaissance. Most early pathologists were also practicing physicians or surgeons. Like other medical fields, pathology has become more specialized with time, and most pathologists today do not practice in other areas of medicine.

**periodontal** 207

**Periodontitis**, formerly known as Pyorrhea alveolaris, is the name of a collection of inflammatory diseases affecting the tissues that surround and support the teeth. Periodontitis involves progressive loss of the bone around teeth which may lead to loosening and eventual loss of teeth if untreated. Periodontitis is caused by bacteria that adhere to and grow on tooth surfaces (microbial plaque or biofilms), particularly in areas under the gum line. Periodontitis is very common in most populations but the severe forms of the disease are less common. Dentists diagnose periodontitis by inspecting the tissues around the teeth with a probe and by radiographs to detect bone loss around the teeth. Although the different forms of periodontitis are bacterial diseases, a variety of factors affect the severity of the disease. Important "risk factors" include smoking, poorly controlled diabetes, and inherited (genetic) susceptibility.
Glossary

**peer-reviewed papers** 217-218, 221, 224

Peer review is a process of subjecting an author's scholarly work, research or ideas to the scrutiny of others who are experts in the same field. It is used primarily by editors to select and to screen submitted manuscripts, and by funding agencies, to decide the awarding of grants. The peer review process aims to make authors meet the standards of their discipline, and of science in general. Publications and awards that have not undergone peer review are likely to be regarded with suspicion by scholars and professionals in many fields. Even refereed journals, however, can contain errors. In the case of manuscripts, the editor will pass manuscripts that are accepted for publication to a publisher who will be responsible for organizing redactory services, printing and distribution of the publication. In specialist academic (scholarly) journals, the editor (or increasingly group of editors) is normally a well-respected academic in the field, and edits the journal on behalf of a learned society or a commercial publisher. Some journals have professional editors employed by the owner of the journal. An editor is ultimately responsible for the quality and selection of manuscripts chosen to be published, usually basing their decision on peer review, although the authors are always responsible for the content of each manuscript. The editor does not revise and correct spelling, grammar and formatting - that process is carried out by a copy editor, although the editor controls the quality of the process.

**peptides** 123-124, 179

Peptides (from the Greek meaning "digestible") are the family of short molecules formed from the linking, in a defined order, of various α-amino acids. The link between one amino acid residue and the next is an amide bond and is sometimes referred to as a peptide bond. Proteins are polypeptide molecules (or consist of multiple polypeptide subunits). The distinction is that peptides are short and polypeptides/proteins are long. There are several different conventions to determine these, all of which have flaws.

**petabyte** 32

A petabyte is a measure of computer storage capacity 2 to the 50th power (1,125,899,906,842,624) bytes. A petabyte is equal to 1,024 terabytes. Petabyte is abbreviated as PB.

**pH factor** (also pH balance; scale; value; ideal; environment; proper; perfect) 94, 95, 113, 119-124

Positive (+) = acid = LOW pH which is cationic, negative (-) = alkaline = HIGH pH which is anionic, pH is on a scale of 1 to 14. The pH scale measures how acidic or alkaline a substance is, pH of 7 is neutral, pH less than 7 is acidic, pH greater than 7 is alkaline.
Glossary

pharmacology  10 101, 126, 225  
Pharmacology is the science or knowledge of drugs or the art of preparing medicines.

physician  10, 164, 186, 192-193, 227-228  
A person skilled in the art of healing; one whose profession is to prescribe remedies for disease.  - Noah Webster  1828  American Dictionary of the English Language

physiology  
Physiology (from Greek: physis, “nature, origin”; and logos, "word or knowledge") is the study of the mechanical, physical, and biochemical functions of living organisms. Physiology has traditionally been divided between plant physiology and animal physiology but the principles of physiology are universal, no matter what particular organism is being studied.

Pi  
Pi or π is the ratio of a circle's circumference to its diameter in Euclidean geometry, approximately 3.14159. Pi is a mathematical constant and a transcendental (and therefore irrational) real number, with many uses in mathematics, physics, and engineering. It is also known as Archimedes' constant (not to be confused with an Archimedes number) and as Ludolph's number. Pi to the 1,000th decimal point:

Pi to the 1,000th decimal point

3.14159265358979323846264338327950288419716939937510582097494459230
7816406286208998628034825342111706798214808651328230664709384460955
05822317253594081128481117450284102701938521110555964462294895493038
1964428810975665933446128475648233786783165271201909145648566692346
034861045432664821339360726024914127372458700660631558817488152092
09628292540917153643678925903600113305054882046652138414695194151
16094330572703657559591953092186117381932611793105511854807446237996
2749567351885752724891122793818301194912983367336244065664308602139
494639522473719070217986094370277053921717629317675238467481846766
9405132000056812714526356082778577134275778960917363717872146844090
122495343014654958537105079227968925892354021995611212902196086403
44181598136297747713099605187072113499999837297804995105973173281
60963185950244594553469083026425223082533446850352619311881710100
313783875288658753320838142061717766914730359825349042875546873115
956286388235378759375195778185778053217122680661300192787661119590
921642019 (no sequence forever)
**pilot survey** 10, 12-14, 28, 45, 88, 207, 210
This is essentially a small scale replica of the actual survey and it is carried out before the actual survey is undertaken. It should duplicate, as near as possible, the survey which is to be made because it may reveal snags in the proposed questions and methods. A pilot survey is very useful when the actual survey is to be on a big scale as it may provide data which will allow costs to be trimmed. Also, a pilot survey will give an estimate of the non-response rate and it will also give a guide as to the adequacy of the sampling frame chosen. In healthcare the pilot survey normally precedes clinical trials.

**placebo** 191-195
A placebo is a sugar pill used in double blind studies with half of the patients getting the drug used in the study and the other half getting the sugar pills. Some placebos have “worked” with the patients up to 40%. There is rumored that in some placebos, a healthy sugar was used instead of a bad sugar. If that were true, it would account for the patients receiving benefits from a sugar pill. The word placebo in the book is mainly to discuss the power of the brain in treatment and the healing process.

**plaque** 100, 158, 178
The word plaque is used in the book to discuss the protein plaque build-up on the synapses of the neurons that contributes to dementia.

**plasticizers** 24-25
Plasticizers for plastics are additive, most commonly phthalates, that give hard plastics like PVC the desired flexibility and durability. They are often based on esters of polycarboxylic acids with linear or branched aliphatic alcohols of moderate chain length. Plasticizers work by embedding themselves between the chains of polymers, spacing them apart (increasing of the "free volume"), and thus significantly lowering the glass transition temperature for the plastic and making it softer. For plastics such as PVC, the more plasticiser added, the lower its cold flex temperature will be. This means that it will be more flexible, though its strength and hardness will decrease as a result of it. Some plasticizers evaporate and tend to concentrate in an enclosed space; the "new car smell" is caused mostly by toxic plasticizers evaporating from the car interior.
**platelet** 211-212; 204-218  
Platelets or thrombocytes are the cell fragments circulating in the blood that are involved in the cellular mechanisms of primary hemostasis leading to the formation of blood clots. Dysfunction or low levels of platelets predisposes to bleeding, while high levels, although usually asymptomatic, may increase the risk of thrombosis. Like red blood cells, platelets are anuclear (no cell nucleus) and discoid (disc shaped); they measure 1.5–3.0 μm in diameter. The body has a very limited reserve of platelets, so they can be rapidly depleted. They contain RNA, mitochondria, a canalicular system, and several different types of granules; lysosomes (containing acid hydrolases), dense bodies (containing ADP, ATP serotonin and calcium) and alpha granules (containing fibrinogen, factor V, vitronectin, thrombospondin and von Willebrand factor), the contents of which are released upon activation of the platelet.

**plethora** 198  
An abnormal bodily condition characterized by an excessive amount of blood in the system.

**PNI (psychoneuroimmunology)** 172  
Psychoneuroimmunology (PNI) is the scientific study of the interaction among emotions, the brain, and the immune system. The brief focus mentioned in the book deals with utilizing humor to help overcoming stress.

**polarization** 179  
In biology, polarization is the increase in the absolute value of a cell's membrane potential. Changes in membrane voltage in which the membrane potential becomes more positive or more negative are both polarizations. The rising and falling phases of an action potential are called polarization or hyperpolarization.

**polypeptides**  
Proteins are polypeptide molecules (or consist of multiple polypeptide subunits). The distinction is that peptides are short and polypeptides/proteins are long. There are several different conventions to determine these, all of which have flaws. Peptides (from the Greek meaning "digestible") are the family of short molecules formed from the linking, in a defined order, of various αα-amino acids. The link between one amino acid residue and the next is an amide bond and is sometimes referred to as a peptide bond.
Glossary

post-synaptic
Information from one neuron flows to another neuron across a synapse. The synapse is a small gap separating neurons. The synapse consists of: a presynaptic ending that contains neurotransmitters, mitochondria and other cell organelles, a postsynaptic ending that contains receptor sites for neurotransmitters and, a synaptic cleft or space between the presynaptic and postsynaptic endings. It is about 20nm wide. An action potential cannot cross the synaptic cleft between neurones. Instead the nerve impulse is carried by chemicals called neurotransmitters. These chemicals are made by the cell that is sending the impulse (the pre-synaptic neurone) and stored in synaptic vesicles at the end of the axon. The cell that is receiving the nerve impulse (the post-synaptic neurone) has chemical-gated ion channels in its membrane, called neuroreceptors. These have specific binding sites for the neurotransmitters.

- from BiologyMad.com, a very interesting website for Biology students in their final year

pregnancy (pregnant) 198-199, 205-206
The gestation period between the fertilization of the egg until birth. In humans that period is approximately nine months.

prescription 199, 228
The term prescription used in the healthcare field usually means a written request by a physician for a drug.

probiotics 153
Probiotics (vs. antibiotics) Biotics means “life”. Probiotics means “for life”. Antibiotics means “against life”. Antibiotics are used to kill the harmful bacteria; unfortunately, they also kill good bacteria. Probiotics are intended to assist the body's natural digestion by helping reestablish gut flora. Probiotics are recommended by some doctors, and recommended by nutritionists, especially after antibiotic treatments, or as part of the treatment for gut related candidiasis. Good digestion via healthy bacteria may prevent the need for antibiotics.

propensity 42, 43, 65-69
The word propensity in Noah Webster’s 1828 Dictionary says: Bent of mind, natural or acquired; inclination; in a moral sense; disposition to any thing good or evil, particularly to evil; as a propensity to sin; the corrupt propensity of the will.

professional 215, 228
A professional is a person who makes evident with documentation, professing to the public that they are an expert in a given vocation or calling. - J. C. Spencer
Glossary

professor 9, 21, 28, 55, 117, 126-127, 161
A professor is a teacher who professes openly to the public to know about and to teach about a particular branch of learning.

proliferating 15
Multiplying or increasing in number. In biology, cell proliferation occurs by a process known as cell division. The term used in the book related to proliferating neurons and specifically the possibility of proliferating stem cells. (From the words pro life duplicating.)

protein 36, 39, 44, 123, 124
Amino acids are the basic building blocks of proteins. A peptide is a compound consisting of 2 or more amino acids. Oligopeptides have 10 or fewer amino acids. Polypeptides and proteins are chains of 10 or more amino acids, but peptides consisting of more than 50 amino acids are classified as proteins.

proteomics 7-9, 39, 123
The study of proteins.

psychiatric
Science dealing with mental challenges.

psychiatrist
A psychiatrist is a physician who specializes in psychiatry and is certified in treating mental illness. As part of their evaluation of the patient, psychiatrists are one of only a few mental health professionals who may prescribe psychiatric medication, conduct physical examinations, order and interpret laboratory tests and electroencephalograms, and may order brain imaging studies such as computed tomography or computed axial tomography, magnetic resonance imaging, and positron emission tomography scanning. A nationwide survey reported that the least religious of all medical specialties is psychiatry. Among psychiatrists who have a religion, more than twice as many are Jewish and far fewer are Protestant or Catholic. The study was published in the 9/07 issue of Psychiatric Services
psychological
Psychology is one of the behavioral sciences—a broad field that spans the social and natural sciences. Psychology attempts to understand the role human behavior plays in social dynamics while incorporating physiological and neurological processes into its conceptions of mental functioning. Psychology includes many sub-fields of study and application concerned with such areas as human development, sports, health, industry, law, and spirituality.

psychologist
A psychologist is a scientist or clinician who studies psychology, the systematic investigation of the human mind, including behavior and cognition. Psychologists are usually categorized under a number of different fields, the most well-recognized being clinical psychologists, who provide mental health care, and research psychologists, who conduct substantive and applied research.

psychology
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psychoneuroimmunology 172
Psychoneuroimmunology (PNI) is the scientific study of the interaction among emotions, the brain, and the immune system. The brief focus mentioned in the book deals with utilizing humor to help overcoming stress.

public (charity; interest; general; -traded; -ily; health) 10, 19, 24, 89, 169, 172-173, 189, 200, 218, 220, 224, 228
The general public in the book normally denotes people who are not necessarily medical professionals.

pyruvate 107
Pyruvate kinase is an enzyme involved in glycolysis. It catalyzes the transfer of a phosphate group from phosphoenolpyruvate (PEP) to ADP, yielding a pyruvate molecule and producing one ATP molecule.
quantum 8, 34, 131
The word quantum means vast quantity. Blackstone says that the quantum valebat is an action to recover from the defendant everything he is worth.

Ranvier
Nodes of Ranvier, or neurofibril nodes are regularly spaced gaps in the myelin sheath around an axon or nerve fiber. About one micrometer in length, these gaps expose the axonal membrane to the extracellular fluid.

In the book the word recall deals with the ability to recall information that is stored in the brain.

REM 181
Rapid eye movement that takes place under the closed eye lids when a person is in deep sleep normally associated with dreaming.

reproach 48, 71-75
The word reproach means to censure mingled with contempt or derision; contumelious or opprobrious language towards any person; abusive reflections; shame; infamy; disgrace; scorn. - Noah Webster 1828 American Dictionary

resistance 147-154
In the book the word resistance is usually associated with friction to create a benefit.

retire (ed; -ment) 163, 191, 228
The word retire as used in the book means to withdraw from use or to go into retirement.

right and wrong (-ness; -eousness; choice(s); signal(s) information; thing; evaluation(s): 15, 24, 54, 62, 63, 73, 108, 127, 128
The words right and wrong as used in the book indicates that right is moving toward approach that will lead to good results or good consequences while wrong is a reproach that leads to bad results or harmful consequences.
Glossary

savant syndrome 135-139
Savant Syndrome is a very rare, but spectacular condition. Savants are, “islands of genius”. Some savants are human calendar calculators and can calculate and tell you the day of the week for any date past or future. Savants may display remarkable gifts and talents in music and art on canvas and in their sculptor work. The savant has the unique ability to collect and recall “memory snapshots” that are lost in the minds of “normal people”. As we better understand Savant Syndrome, we can better understand the human brain. To better understand the savant view a collection of video clips, see the link at www.EndowmentMed.org.

savor (-ing) 42, 48, 85, 86, 143
Savor as used in the book means to enjoy the pleasant flavor, to taste something that is pleasurably recorded, normally through the tongue, as one of the five senses of sight, sound, smell, savor, and sensuality.

schizophrenia 216
Schizophrenia is a severe, lifelong brain disorder. People who have it may hear voices, see things that aren’t there or believe that others are reading or controlling their minds. In men, symptoms usually start in the late teens and early 20s. They include hallucinations, or seeing things, and delusions such as hearing voices. For women, they start in the mid-20s to early 30s. Other symptoms include: (1) Unusual thoughts or perceptions; (2) Disorders of movement; (3) Difficulty speaking and expressing emotion; and (4) Problems with attention, memory and organization. No one is sure what causes schizophrenia, but your genetic makeup and brain chemistry probably play a role. Medicines can relieve many of the symptoms, but it can take several tries before you find the right drug. You can reduce relapses by staying on your medicine for as long as your doctor recommends. With treatment, many people improve enough to lead satisfying lives. - National Institute of Mental Health

schools of thought (schools of neurons) 18, 20, 31, 51, 77-78, 125-128, 139, 141-146, 148, 162, 170, 172, 180, 193, 198, 200, 205, 210, 219, 221, 224-227
In the book, I attempt to give an elementary graphic explanation how the neurons work. Since billions of neurons are in a liquid or gel and act in concert, I use the expressions: “a cascade of neurons respond like a flock of birds in flight”, “schools of thought”, and “schools of neurons”.

- J. C. Spencer
Also see **clique** as used in the book is a restricted group of neurons within a “school” of neurons who share common interests. These **cliques** are often a part of a larger group or groups and are normally associated with neurons that have been pre-programmed with specific interests.

**Schwann cell** 37
Schwann cells are known for their role in supporting nerve regeneration. Named after the German physiologist Theodor Schwann, **Schwann cells** (also referred to as **neurolemmocytes**) are a variety of neuroglia that mainly provide myelin insulation to axons in the peripheral nervous system of jawed vertebrates. The vertebrate nervous system relies on this myelin sheath for insulation and as a method of decreasing membrane capacitance in the axon, thus allowing for saltatory conduction to occur and for an increase in impulse speed, without an increase in axonal diameter. Non-myelinating Schwann cells are involved in maintenance of axons and are crucial for neuronal survival. Some group around smaller axons and form Remak bundles. Schwann cells are the peripheral nervous system's analogues of the central nervous system oligodendrocytes. Schwann cells begin to form the myelin sheath in mammals during fetal development and work by spiraling around the axon, sometimes with as many as 100 revolutions. A well-developed Schwann cell is shaped like a rolled-up sheet of paper, with layers of myelin in between each coil. The inner layers of the wrapping, which are predominantly membrane material, form the myelin sheath while the outermost layer of nucleated cytoplasm forms the neurolemma. The gaps between the Schwann cell covered segments are the Nodes of Ranvier, important sites of ionic and other exchanges of the axon with the extracellular liquid. Unlike oligodendrocytes, myelinating Schwann cells provide insulation to only one axon (see image: The red dots on the axons are Schwann cells). This arrangement permits saltatory conduction of action potentials which greatly speeds it and saves energy.
scurvy  154
Scurvy leads to the formation of liver spots on the skin, spongy gums, and bleeding from mucous membranes. The spots are most abundant on the thighs and legs, and a person with the ailment looks pale, feels depressed, and is partially immobilized. In advanced scurvy there are open, suppurating wounds and loss of teeth. Untreated scurvy is always fatal. Scurvy happens when humans cannot synthesize vitamin C. Lacking is the enzyme L-gluconolactone which converts L-gluconogam-malactone to L-ascorbic acid. Vitamin C is also essential for collagen synthesis. Any deficiency will affect any organ or structure that requires collagen. Juice from a lemon is the cure for scurvy. The British used the lemon as the evidenced cure of scurvy. The lemon made history when British sailors became ill during long voyages at sea. After they ate lemons from the islands, they conquered scurvy and the endearing term for the British sailor became Limey.

senescent cell  103
The cell that will not divide is called a senescent cell. The senescent cell is very much alive but simply cannot divide. The senescent cell contributes to wrinkles, the aging look and tired feeling. When the cell begins to malfunction, the immune system is compromised soon resulting in chaos.

sensuality  42, 48, 85, 143
The word sensuality in the book denotes sensation or gratification of memorable touch as one of the five senses of sight, sound, smell, savor, and sensuality. The sensual touch can be positive moving toward what is right. The propensity of the heart determines great glory or great devastation. The word “senses” is derived from sensual pleasures of the flesh based upon touch or reaching out for more with an unquenchable appetite of indulgence concluded in animalistic debasement. The outcome of sensuality is determined by virtue.

- J. C. Spencer

serotonin  114, 205
Serotonin is a monoamine neurotransmitter synthesized in serotonergic neurons in the central nervous system (CNS) and enterochromaffin cells in the gastrointestinal tract. Serotonin is also found in mushrooms and plants, including fruits and vegetables.
Glossary

**side effects** 12, 193
Side effects normally refers to adverse drug reaction or an unintended consequence specifically arising from drug therapy. While this is the accepted medical definition, in reality, there can be positive side effects. In good nutrition, there are often positive side effects that are beneficial to your health. The name for positive side effects is serendipity.

**sight** 42, 48, 85, 143
The word *sight* in the book denotes a visible sense seen with the eye as one of the five senses of *sight*, sound, smell, savor, and sensuality.

**smell** 42, 48, 85, 143
The word *smell* in the book denotes the ability to sense a scent, an odor, that is recorded through the nose as one of the five senses of sight, sound, *smell*, savor, and sensuality.

**soil** 120, 121, 124
The *soil* is home for the seed and gives the seed LIFE and the nourishment for growth. With this foundational understanding, in my teachings, I liken the membrane of the cell to *soil* through which the glycoprotein receptor sites protrude and appear on the cell like trees on the surface of the earth. Another use for the word *soil*, I use in my Bible classes, is that words are seed sown into the *soil* of our souls and the type of seed and the nurturing of that seed is what forms character.

- J. C. Spencer

**sound** 42, 48, 85, 143
The word *sound* in the book denotes the ability to exercise the sense to hear audibly music, voice, or noise; an impulse of the air that strikes an organ of hearing; vibrations that are recorded through the ear as one of the five senses of sight, *sound*, smell, savor, and sensuality.
spelunking  91
Spelunking is the recreational sport of exploring caves. Speleology is the scientific study of caves and the cave environment. The challenges of the sport depend on the cave being visited, but often include the negotiation of pitches, squeezes, and water. Climbing or crawling is often necessary, and ropes are used extensively. Caves have been explored out of necessity for thousands of years, but only in the last century or two has the activity developed into a sophisticated, athletic pastime. In recent decades caving has changed considerably due to the availability of modern protective wear and equipment. It has recently come to be known as an "extreme sport" by some (though not commonly considered as such by its practitioners, who may dislike the term for its perceived connotation of disregard for safety). Many of the skills of caving can also be used in the nature activities of other explorations. The author was proud of the fact that he discovered an uncharted underground waterfall in the third largest cave in the United States, Marvel Cave at Silver Dollar City near Branson, Missouri, thirty five miles from my birth place near Crane, Missouri.

standard  20, 33, 62, 68, 71-76
A standard is what a person stands for, that which is established as a rule, a measure, a model, by which it is the objective to attain. The standard becomes the authority. To stand for a standard is to decide to both commit to and surrender to the authority of the standard.

stem cells  15, 28
The expression stem cells used in the book are adult stem cells and not embryonic stem cells. Adult stem cells have two qualifying factors: the ability to divide and create another cell like itself and also the ability to divide and create a specifically needed cell different than itself. Different stem cells have unique abilities to come to the aid of specific organs and are generally referred to by their tissue origin. Adult stem cell research has focused on clarifying their capacity to divide or self-renew indefinitely and their differentiation potential. In mice, pluripotent stem cells can be directly generated from adult fibroblast cultures. Embryonic stem cells have the potential to do more harm that good and have become a political football. The use of adult stem cells in research and therapy is not controversial like embryonic stem cell research. The production of adult stem cells does not require the destruction of an life. Proliferation of stem cells in the human body without a transplant is the object and passion of research in which the author is interested.
stimulate 19, 21, 27
In the book, the normal use of the word stimulate is to excite to action the neurons of the brain.

sucrose
Sucrose is a disaccharide that yields 1 equiv of glucose and 1 equiv of fructose on acidic hydrolysis. This 1:1 mixture of glucose and fructose is often referred to as invert sugar, since the sign of optical rotation changes (inverts) during the hydrolysis from sucrose ([alpha]D = +66.5°) to a glucose fructose mixture ([alpha]D = -22.0°). Unlike most other disaccharides, sucrose is not a reducing sugar and does not exhibit mutarotation. These facts imply that sucrose has no hemiacetal linkages and that glucose and fructose must both be glycosides. This can happen only if the two sugars are joined by a glycoside link between C1 of glucose and C2 of fructose.

- Karl Harrison

When the word sugar is used, most people think of normal table sugar. In non-scientific use, the term sugar refers to sucrose (or "saccharose") - a white crystalline solid disaccharide. It is reported that there are some 200 sugars found in nature and only recently has the science of sugar taken on a whole new role. Previously it was believed that sugar was used only for energy. There are "bad sugars", good sugars", and "super sugars". Glycomics is the study of applied biology and chemistry that deals with the structure and function of carbohydrates (sugars). The term glycomics is derived from the chemical prefix for sweetness or a sugar, 'glyco', and was formed to follow the naming convention established by genomics (which deal with genes) and proteomics (which deals with proteins)."

- quote from the Institute for Glycomics at Griffith University

The human glycome is the sum total of all the simple and complex carbohydrates in humans. Human glycomics is the in depth study of the structures and functions of all the molecules present in our glycome and all the factors that affect them. Studies in glycomics (human and other [horse, dog, etc]) will impact wellness and many diseases. Possible benefits include development of new markers for wellness and new glyconutritional approaches to sustain wellness. New insights into arthritis, autoimmune diseases, cancer, cardiovascular disease, chronic neurologic disorders, genetic diseases and infectious diseases, among others, should be afforded by glycomic studies. Glycomic approaches should help to crack the sugar code of life.

- Robert K. Murray, MD, PhD
supplementation 14, 25, 33, 100, 220, 222-223, 228
Supplementation is needed when the conventional source is inadequate. Today thousands of published papers espouse the need for supplementation of our normal food intake because the fruits and vegetables do not have the nutrients that they had a few years ago due to depleted soil and added toxins.

dyslexia 19, 24, 80, 200
A dyslexia is a learning disability, sometimes called reading disability, that is defined as difficulty in learning to read or learn to read well. It is found in approximately 10% of school age children.

dyslexia 19, 24, 80, 200
A dyslexia is a learning disability, sometimes called reading disability, that is defined as difficulty in learning to read or learn to read well. It is found in approximately 10% of school age children.
Glossary

**synapse** 30, 155-166, 178-181

*Synapse* are the contact points of the neurons that make us the neurotransmitters that are at the heart of cognitive science. The brain is neurotransmitters and the synapse make it happen. A normal brain may have over 100 billions neurons. Each neuron reaches out to touch other neurons through its axon. Each neuron is connected to hundreds of other neurons by way of as many as ten thousand synapses. The equation of how many synapses are in a brain is as incalculable as the sands of the seas or the stars of the heavens. A biologist and Nobel Prize winner said that just to count the synapses in the brain would take thirty two million years. Another scientist confirms that new synapses are added as you learn.

**synchronize**

To synchronize is to make operate at the same rate of speed; to be congruent and brought into harmony.


A *system* is a design with a designated function be it an atom, a molecule, a cell, a body, a country, the earth or the complete universe. A *system* contributes to and is accountable to a larger *system*. When the function of a system fits the design, there is harmony. When the function does not fit the design, there is chaos.

- J. C. Spencer

**telomere**

The author has, for a number of years, believe that the research conducted into understanding the *telomere* is one of the most fascinating ventures in science (Any new information on *telomere* research is welcome and will be appreciated. Also, any paper debating the following information is welcome.): A *telomere* is a region of highly repetitive DNA at the end of a linear chromosome that functions as a disposable buffer. Every time linear eukaryotic chromosomes are replicated during late S phase, the DNA polymerase complex is incapable of replicating all the way to the end of the chromosome; if it were not for *telomeres*, this would quickly result in the loss of vital genetic information, which is needed to sustain a cell's activities. Every time a cell with linear chromosomes divides, it will lose a small piece of one of its strands of DNA. This process has been referred to by James Watson and Alexei Olovnikov as the "end replication problem" (1971). It is believed that *telomeres* have a function in the ageing process.
Glossary

The telomere is a "ribonucleoprotein complex" composed of a protein component and an RNA primer sequence which acts to protect the terminal ends of chromosomes. This is because during replication, DNA polymerase can only synthesize DNA in a 5'to 3'direction and can only do so by adding polynucleotides to an RNA primer that has already been placed at various points along the length of the DNA. These RNA strands must later be replaced with DNA. At the terminal of the DNA strand, the RNA primer is laid but DNA polymerase cannot extend beyond it. This RNA primer will not later be replaced by DNA, and therefore cannot be translated into gene products or replicated later. Without telomeres at the end of DNA, this genetic sequence would be deleted and the chromosome would grow shorter and shorter in subsequent replications. The telomere prevents this problem by employing a different mechanism to synthesize DNA at this point, thereby preserving the sequence at the terminal of the chromosome. This prevents chromosomal fraying and prevents the ends of the chromosome from being processed as a double strand DNA break, which could lead to chromosome-to-chromosome telomere fusions. Telomeres are extended by telomerases, part of a protein subgroup of specialized reverse transcriptase enzymes known as TERT (TElomerase ReVerse Transcriptases) that are involved in synthesis of telomeres in humans and many other, but not all, organisms. However, because of DNA replication mechanisms and because TERT expression is repressed in many types of human cells, the telomeres of these cells shrink a little bit every time a cell divides although in other cellular compartments which require extensive cell division, such as stem cells and certain white blood cells, TERT is expressed and telomere length is maintained.

Structure of parallel quadruplexes that can be formed by human telomeric DNA. In addition to its TERT protein component, telomerase also contains a piece of template RNA known as the TERC (TElomerase RNA Component) or TR (Telomerase RNA). In humans, this TERC telomere sequence is a repeating string of TTAGGG, between 3 and 20 kilobases in length. There are an additional 100-300 kilobases of telomere-associated repeats between the telomere and the rest of the chromosome. Telomere sequences vary from species to species, but are generally GC-rich. These GC-rich sequences can form four-stranded structures (G-quadruplexes), with sets of four bases held in plane and then stacked on top of each other with either a sodium or potassium ion between the planar quadruplexes.
In most prokaryotes, chromosomes are circular and thus do not have ends to suffer premature replication termination. A small fraction of bacterial chromosomes (such as those in Streptomyces and Borrelia) are linear and possess telomeres, which are very different from those of the eukaryotic chromosomes in structure and functions. In most multicellular eukaryotes, telomerase is only active in germ cells. There are theories that the steady shortening of telomeres with each replication in somatic (body) cells may have a role in senescence and in the prevention of cancer. This is because the telomeres act as a sort of time-delay "fuse", eventually running out after a certain number of cell divisions and resulting in the eventual loss of vital genetic information from the cell's chromosome with future divisions.

If telomeres become too short, they will potentially unfold from their presumed closed structure. It is thought that the cell detects this uncapping as DNA damage and will enter cellular senescence, growth arrest or apoptosis depending on the cell's genetic background (p53 status). Uncapped telomeres also result in chromosomal fusions. Since this damage cannot be repaired in normal somatic cells, the cell may even go into apoptosis. Many aging-related diseases are linked to shortened telomeres. Organs deteriorate as more and more of their cells die off or enter cellular senescence.

At the very distal end of the telomere is a 300 bp single-stranded portion which forms the T-Loop. This loop is analogous to a 'knot' which stabilizes the telomere; preventing the telomere ends from being recognized as break points by the DNA repair machinery. Should non-homologous end joining occur at the telomeric ends, chromosomal fusion will result. The T-loop is held together by seven known proteins; most notably TRF1, TRF2, POT1, TIN1, and TIN2.

A study published in the May 3, 2005 issue of the American Heart Association journal Circulation found that weight gain and increased insulin resistance were correlated with greater telomere shortening over time.

"Telomeres" shorten because of the end replication problem that is exhibited during DNA replication in eukaryotes only. Because DNA replication does not begin at either end of the DNA strand, but starts in the center, and considering that all DNA polymerases that have been discovered move in the 5' to 3' direction, one finds a leading and a lagging strand on the DNA molecule being replicated.
On the leading strand, DNA polymerase can make a complementary DNA strand without any difficulty because it goes from 5’ to 3’. However, there is a problem going in the other direction on the lagging strand. To counter this, short sequences of RNA acting as primers attach to the lagging strand a little way ahead of where the initiation site was. The DNA polymerase can start replication at that point and go to the end of the initiation site. This causes the formation of Okazaki fragments. More RNA primers attach further on the DNA strand and DNA polymerase comes along and continues to make a new DNA strand.

Eventually, the last RNA attaches, and DNA polymerase and DNA ligase come along to convert the RNA (of the primers) to DNA, and seal the gaps in between the Okazaki fragments. But in order to change RNA to DNA, there must be another DNA strand in front of the RNA primer. This happens at all the sites of the lagging strand, but it doesn't happen at the end where the last RNA primer is attached. Ultimately, that RNA is destroyed by enzymes that degrade RNA left on the DNA. Thus, a section of telomeres is lost during each cycle of replication at the 5’ end of both the leading and lagging strands.

The phenomenon of limited cellular division was first observed by Leonard Hayflick. Significant discoveries were made by the team led by Professor Elizabeth Blackburn at the University of California - San Francisco. In 1998, it was reported that the Geron Corp. developed techniques for extending telomeres, and demonstrated that this prevented cellular senescence.

Advocates of human life extension promote the idea of lengthening the telomeres in certain cells through temporary activation of telomerase (by drugs), or possibly permanently by gene therapy. They reason that this would extend human life. So far these ideas have not been proven in humans.

However, it has been hypothesized that there is a trade-off between cancerous tumor suppression and tissue repair capacity, and that by lengthening telomeres we might slow aging and in exchange increase vulnerability to cancer (Weinstein and Ciszek, 2002).
A study done with the nematode worm species Caenorhabditis elegans indicates that there is a correlation between lengthening telomeres and a longer lifespan. Two groups of worms were studied which differed in the amount of the protein HRP-1 their cells produced, resulting in telomere lengthening in the mutant worms. The worms with the longer telomeres lived 24 days on average, about 20 percent longer than the normal worms. A side effect of the mutation was an increased resistance to the effects of heat exposure. The reasons for that effect are unclear. (Joeng et al., 2004).

Techniques to extend telomeres could be useful for tissue engineering, because they might permit healthy, noncancerous mammalian cells to be cultured in amounts large enough to be engineering materials for biomedical repairs.

However, there are several issues that still need to be cleared up. First, it is not even certain whether the relationship between telomeres and aging is causal. Although this is indeed probably so because changing telomere lengths are usually associated with changing speed of senescence, the relationship may well be the other way around, with telomere shortening a consequence of and not a reason for aging. That the role of telomeres is far from being understood is demonstrated by two recent studies on long-lived seabirds:

In 2003, scientists observed that the telomeres of Leach's Storm-petrel (Oceanodroma leucorhoa) seem to lengthen with chronological age, the first observed instance of such behaviour of telomeres. In 2006, Juola et al. reported that in another, unrelated long-lived seabird species, the Great Frigatebird (Fregata minor), telomere length did decrease until at least c.40 years of age (i.e. probably over the entire lifespan), but the speed of decrease slowed down massively with increasing ages, and that rates of telomere length decrease varied strongly between individual birds. They concluded that in this species (and probably in frigatebirds and their relatives in general), telomere length could not be used to determine a bird's age sufficiently well. Thus, it seems that there is much more variation in the behavior of telomere length than initially believed, and more research into the topic is clearly warranted before any firm conclusions can be drawn or even practical applications tested.

Several techniques are currently employed to assess average telomere length in eukaryotic cells. The most widely used method is the Terminal Restriction Fragment (TRF) southern blot which involves hybridization of a radioactive 32P-(TTAGGG)n oligonucleotide probe to Hinf / Rsa I digested genomic DNA embedded on a nylon membrane; and subsequently exposed to autoradiographic film or phosphoimager screen. Another histochemical method involves fluorescent in situ hybridization (FISH).
Glossary

These methods however, require significant amounts of genomic DNA (2-20 micrograms) and labor which renders its use limited in large epidemiological studies. These impediments have been overcome with a novel Real-Time PCR assay for telomere length developed by Richard Cawthon at the University of Utah. This assay involves determining the Telomere-to-Single Copy Gene (T/S) ratio which is demonstrated to be proportional to the average telomere length in a cell (Cawthon 2002). The Real-Time PCR assay has been since redeveloped in a high-throughput 384-well format for use with an Applied Biosystems 7900HT by Jason Wong of the Brigham and Women's Hospital / Harvard Medical School; making the assay feasible for use in large cohort studies. The high-throughput assay has been brought into large epidemiology investigations on genomic DNA samples from healthy subjects by Andrea Baccarelli’s lab at the University of Milan.

Telomere maintenance activity is a hallmark in approximately 90% of cancers in almost all mammalian organisms. In humans, cancerous tumors acquire indefinite replicative capacity by over-expressing telomerase. However, a sizeable fraction of cancerous cells employ alternative lengthening of telomeres (ALT), a non-conservative telomere lengthening pathway involving the transfer of telomere tandem repeats between sister-chromatids. The mechanism by which ALT is activated is not fully understood because these exchange events are difficult to assess in vivo.


Related papers: Bret Weinstein and Deborah Ciszek; The Reserve Capacity Hypothesis: A paper detailing the evolutionary origins and medical implications of the vertebrate telomere system, including the pervasive trade-off between cancer prevention and damage repair. Also addresses the probable danger posed by the elongation of telomeres in lab mice. Yu-Sheng Cong, Woodring E. Wright, and Jerry W. Shay; Human Telomerase and Its Regulation Susan Bassham, Aaron Beam, and Janis Shampay; Telomere Variation in Xenopus laevis

- From Wikipedia, the free encyclopedia
Glossary

**tendons** 210
A tendon (or sinew) is a tough band of fibrous connective tissue forming a cord that connects muscle to bone and is built to withstand tension. Tendons are similar to ligaments except that ligaments join one bone to another. Tendons and muscles work together and can only exert a pulling force. A tendon is a passive material, lengthening when the tension increases and shortening when it decreases. This characteristic contrasts with the active behavior of muscle. Away from its muscle, a tendon is a compact cord. At the muscle, it spreads into thin sheets called aponeuroses, which lie over and sometimes within the muscle belly. The large surface area of the aponeuroses allows the attachment of muscle fibers with a total cross-sectional area that is typically 50 times that of the tendon.

**terabyte** 32
A terabyte is a measure of computer storage capacity and is 2 to the 40th power or approximately a thousand billion bytes (that is, a thousand gigabytes). Abbreviation is TB.

**TGF-B (transforming growth factor-B)**
See transforming growth factor-B

**thought** 13, 19, 21, 25, 27, 29-31, 34, 47-52, 60, 67, 71-75, 77, 79, 86, 94, 121, 125-128, 132, 139, 141-142, 145
**Thought** or thinking is a mental process that takes any image or idea and processes it through the neurons of the brain. More advanced though may take new images and new ideas and draw from stored information regarding this new information to come up with more new concepts. By processing the information with perception, greater problems can be solved, discussions can be made, reasonable minds can work together. Expanding the mind and improving brain function involves cerebral exercises to form new concepts and make wiser decisions. Becoming able to think with a higher cognitive function and greater thinking processes is the objective.
**Glossary**

**toxemia** 208

**Toxemia** is the presence of toxins in the blood. It is a serious medical condition that usually affects women after 20 weeks of pregnancy. Toxemia is also known as preeclampsia or pregnancy-induced hypertension (PIH), toxemia is characterized by sudden elevated blood pressure and the presence of excess protein in the urine. If toxemia is left undiagnosed and untreated, the continuous increase in blood pressure can lead to deadly complications for both mother and baby. In fact, toxemia and other diseases associated with high blood pressure are leading causes of maternal and infant mortality worldwide. At present, there are no known causes that trigger the onset of this ailment. However, there are documented risk factors that may cause some women to be predisposed to toxemia. Being pregnant in itself carries the biggest risk of this problem. The incidence of toxemia is higher in first pregnancies. Women who become pregnant for the first time in a decade or longer are also at an increased risk. Multiple births increase a woman's risk of developing toxemia. Past medical statistics have shown that toxemia occurs more often in women carrying twins, triplets, or more children.

**toxicology** 24, 80, 245

**Toxicology** is the study of the adverse effects of chemicals on living organisms. It is the study of symptoms, mechanisms, treatments and detection of poisoning, especially the poisoning of people.

**toxins** 24-25, 67, 75, 80, 100, 161-162, 179, 195, 246

**Toxins** are poisons that are permeating our air, water, and foods. A study of new toxins reveal that many of these killer toxins did not exist before 1940. It is very important that we detox our bodies safely.

**trans-fatty acids**

**Trans** unsaturated fatty acids, or **trans** fats, are solid fats produced artificially by heating liquid vegetable oils in the presence of metal catalysts and hydrogen.¹ This process, partial hydrogenation, causes carbon atoms to bond in a straight configuration and remain in a solid state at room temperature. Naturally-occurring unsaturated fatty acids have carbon atoms that line up in a bent shape, resulting in a liquid state at room temperature.
Glossary

Under new FDA guidelines, as of January 1, 2006, trans fat must be listed on food labels in the U.S. The trans fat labeling requirement is the first significant change to the Nutrition Facts panel since the Nutritional, Labeling, and Education Act regulations were finalized in 1993, according to the FDA. Harvard School of Public Health researchers helped sound the alarm about trans fat and coronary heart disease risk in the early 1990s and advocated that it be explicitly listed on food labels. In an updated analysis of the trans fat-heart disease link, HSPH researchers have found that removing trans fats from the industrial food supply could prevent tens of thousands of heart attacks and cardiac deaths each year in the U.S.(1) The findings are published in the April 13, 2006 issue of the New England Journal of Medicine.

Harvard School of Public Health, Boston, MA

transforming growth factor-B (TGF-B)
Transforming growth factor (TGF)-beta1 is a pluripotent cytokine that profoundly inhibits epithelial proliferation, induces apoptosis, and influences morphogenesis by mediating extracellular matrix deposition and remodeling.

transgene 238-240
A transgene is a gene or genetic material which has been transferred by a genetic engineering techniques from one organism to another. The term transgene describes a segment of DNA containing a gene sequence which has been isolated from one organism and is introduced into a different organism. This non-native segment of DNA may retain the ability to produce RNA or protein in the transgenic organism or it may alter the normal function of the transgenic organism's genetic code. Typically the DNA is incorporated into the organism's germ line. For example, in higher vertebrates this can be accomplished by injecting the foreign DNA into the nucleus of a fertilized embryo. This technique is routinely used to introduce human disease genes or other genes of interest into strains of laboratory mice to study the function or pathology involved with that particular gene.

- From Wikipedia, the free encyclopedia
Trehalose is a naturally occurring sugar energy source with 45% the sweetness of sucrose. It is a white crystalline powder (trehalose dehydrate) produced from cornstarch. It is approved as a food in over 40 countries including the US. Studies indicate that trehalose strengthens the cell membrane on which glycoprotein receptor sites reside. Research is ongoing to elucidate the relationship between metabolic parameters and the potential energy and performance benefits of Trehalose. Research shows that sufferers of Huntington’s Chorea, a polyglutamine storage disorder with a genetic basis, may benefit from the disaccharide trehalose. Published science papers include Trehalose alleviates polyglutamine-mediated pathology in a mouse model of Huntington disease and Sweet Relief for Huntington Disease. The same mechanism of action involving trehalose that worked in the Huntington’s Chorea genetic knockout mice study may also be at work with other similar conditions such as Alzheimer’s and Parkinson disease. The trehalose structural formula is a non-reducing disaccharide of two glucose molecules bonded by a $\alpha_1, \alpha_1$ glycosidic link. Trehalose is stable at low pH conditions and is non-hygroscopic, which results in a free-flowing dry crystal that is stable to ninety-four percent (94%) humidity. It has a clean profile, which means it has no aftertaste.

Transcellular
Transcellular transport is where the substances travel through the cell, passing through both the apical membrane and basolateral membrane. The distinction is in particular significance in renal physiology. Transcellular transport is more likely to involve energy expenditure than paracellular transport. Capillaries of the Blood Brain Barrier (BBB) have transcellular transport only in contrast with normal capillaries which have both transcellular and paracellular transport. This is due to the presence of tight junctions in the BBB and Astrocytes that surround the capillaries.

Trauma
Physical trauma refers to a physical injury. A trauma patient is someone who has suffered serious and life-threatening physical injury potentially resulting in secondary complications such as shock, respiratory failure and death.
triglycerides  204  
Triglycerides are the chemical form in which most fat exists in food as well as in the body. They're also present in blood plasma and, in association with cholesterol, form the plasma lipids. Triglycerides in plasma are derived from fats eaten in foods or made in the body from other energy sources like carbohydrates. Calories ingested in a meal and not used immediately by tissues are converted to triglycerides and transported to fat cells to be stored. Hormones regulate the release of triglycerides from fat tissue so they meet the body's needs for energy between meals. Excess triglycerides in plasma is called hypertriglyceridemia. It's linked to the occurrence of coronary artery disease in some people. Elevated triglycerides may be a consequence of other disease, such as untreated diabetes mellitus. Like cholesterol, increases in triglyceride levels can be detected by plasma measurements. These measurements should be made after an overnight food and alcohol fast.

ulcers  (-s; -ative)  206  
A peptic ulcer is a sore or hole in the lining of the stomach or duodenum (the first part of the small intestine). People of any age can get an ulcer and women are affected just as often as men. It is projected that over 25 million Americans will suffer from an ulcer at some point during their life. The good news is that most ulcers are caused by an infection with the bacterium, Helicobacter pylori. Conventional therapy is with antibiotics.

A university is a school of high learning. These contributed someway to the book.

virus  55-57  
A virus is a miss folded protein. A virus is a tiny evil commando that doesn't eat, secrete, or propel itself. It is unable to reproduce without the aid of another living cell. The virus follows its pre-programmed instructions to reprogram the cells of another organism, making that organism the host. By reprogramming the host cell the virus causes that cell to become a traitor, directing it to cease its DESIGNED FUNCTION and instead to replicate the invader, producing clones of the virus.  - J. C. Spencer  "The virus then seizes key positions in the host's body and spreads to other hosts-in-waiting at the first opportunity. "Some viruses attack and disable their victims with cruel speed. ... Other viruses take years to harm their hosts. AIDS can incubate for up to a decade, allowing the deadly agent plenty of time to pass to new hosts before its ill-effects become apparent. Others [viruses], such as herpes simplex, co-exists so well
we're often unaware of their presence."

- Reference see page 56

**varicose veins** 207
Varicose veins are enlarged veins that are swollen and raised above the surface of the skin. They can be dark purple or blue, and look twisted and bulging. Varicose veins are commonly found on the backs of the calves or on the inside of the leg. They develop when valves in the veins that allow blood to flow toward the heart stop working properly. As a result, blood pools in the veins and causes them to get larger. Varicose veins affect 1 out of 2 people over age 50. They are more common in women than men. Spider veins are like varicose veins, but they are smaller.

**water** (-ed; -fall, -ways, -carrying; molecule(s)) 24, 45, 54, 86, 94-96, 100-102, 104, 112-113, 116-118, 121, 123-124
Water is H₂O and gives life to the planet. Blood is life to the body and water is life to the blood. The pH of water is important and discussed in the book. The ionic charge of water is important. Water, the universal solvent, is virtually impossible to keep pure for very long because of its ability to absorb contaminants. Clean water helps flush toxins out of the body. Most people need to drink more water than they do.

**wellness** 224, 226
Wellness means well-being, a healthy body and mind. The focus should be on wellness instead of sickness. The current shift in healthcare is to move away from sickness care.
Glossary

Individuals Referenced

These individuals have been my teachers. These scientists, researchers, writers, and individuals contributed greatly to this book. Thank you for the work you have done to benefit others! Without the faithful staff at The Endowment for Medical Research, none of this would have manifest.

Legend:

✈️ = speaker we have engaged at an event of The Endowment for Medical Research.

✈️✈️ = Speaker, available for speaking engagements. On the Speaker's Bureau of The Endowment for Medical Research.

⏰ = Served on the staff or volunteered time for The Endowment for Medical Research.

✍️ = Those who helped edit and/or make suggestions to Expand your mind - Improve your brain.

🔍 = Authored or co-authored a published paper(s) or article(s) referenced in the book.
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Dietary Supplement Health and Education Act of 1994
Public Law 103-417
103rd Congress

An Act

To amend the Federal Food, Drug, and Cosmetic Act to establish standards with respect to dietary supplements, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

§1. Short Title; Reference; Table Of Contents.
   (a) Short Title.

This Act may be cited as the "Dietary Supplement Health and Education Act of 1994".

   (b) Reference.

Whenever in this Act an amendment or repeal is expressed in terms of an amendment to, or repeal of, a section or other provision, the reference shall be considered to be made to a section or other provision of the Federal Food, Drug, and Cosmetic Act.

   (c) Table of Contents.

The table of contents of this Act is as follows:

Sec. 1. Short title; reference; table of contents.
Sec. 2. Findings.
Sec. 3. Definitions.
§2. Findings.

Congress finds that -

(1) improving the health status of United States citizens ranks at the top of the national priorities of the Federal Government;

(2) the importance of nutrition and the benefits of dietary supplements to health promotion and disease prevention have been documented increasingly in scientific studies;

(3)(A) there is a link between the ingestion of certain nutrients or dietary supplements and the prevention of chronic diseases such as cancer, heart disease, and osteoporosis; and

(B) clinical research has shown that several chronic diseases can be prevented simply with a healthful diet, such as a diet that is low in fat, saturated fat, cholesterol, and sodium, with a high proportion of plant-based foods;

(4) healthful diets may mitigate the need for expensive medical procedures, such as coronary bypass surgery or angioplasty;

(5) preventive health measures, including education, good nutrition, and appropriate use of safe nutritional supplements will limit the incidence of chronic diseases, and reduce long-term health care expenditures;

(6)(A) promotion of good health and healthy lifestyles improves and extends lives while reducing health care expenditures; and

(B) reduction in health care expenditures is of paramount importance to the future of the country and the economic well-being of the country;
(7) there is a growing need for emphasis on the dissemination of information linking nutrition and long-term good health;
(8) consumers should be empowered to make choices about preventive health care programs based on data from scientific studies of health benefits related to particular dietary supplements;
(9) national surveys have revealed that almost 50 percent of the 260,000,000 Americans regularly consume dietary supplements of vitamins, minerals, or herbs as a means of improving their nutrition;
(10) studies indicate that consumers are placing increased reliance on the use of nontraditional health care providers to avoid the excessive costs of traditional medical services and to obtain more holistic consideration of their needs;
(11) the United States will spend over $1,000,000,000,000 on health care in 1994, which is about 12 percent of the Gross National Product of the United States, and this amount and percentage will continue to increase unless significant efforts are undertaken to reverse the increase;
(12) (A) the nutritional supplement industry is an integral part of the economy of the United States;
      (B) the industry consistently projects a positive trade balance; and
      (C) the estimated 600 dietary supplement manufacturers in the United States produce approximately 4,000 products, with total annual sales of such products alone reaching at least $4,000,000,000;
(13) although the Federal Government should take swift action against products that are unsafe or adulterated, the Federal Government should not take any actions to impose unreasonable regulatory barriers limiting or slowing the flow of safe products and accurate information to consumers;
(14) dietary supplements are safe within a broad range of intake, and safety problems with the supplements are relatively rare; and
(15)(A) legislative action that protects the right of access of consumers to safe dietary supplements is necessary in order to promote wellness; and

(B) a rational Federal framework must be established to supersede the current ad hoc, patchwork regulatory policy on dietary supplements.

§3. Definitions.

(a) Definition of Certain Foods as Dietary Supplements. Section 201 (21 U.S.C. 321) is amended by adding at the end the following:

"(ff) The term "dietary supplement" -

"(1) means a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following dietary ingredients:

"(A) a vitamin;
"(B) a mineral;
"(C) an herb or other botanical;
"(D) an amino acid;
"(E) a dietary substance for use by man to supplement the diet by increasing the total dietary intake; or
"(F) a concentrate, metabolite, constituent, extract, or combination of any ingredient described in clause (A), (B), (C), (D), or (E);

"(2) means a product that -

"(A)(i) is intended for ingestion in a form described in section 411(c)(1)(B)(i); or
"(ii) complies with section 411(c)(1)(B)(ii);
"(B) is not represented for use as a conventional food or as a sole item of a meal or the diet; and
"(C) is labeled as a dietary supplement; and

"(3) does -
"(A) include an article that is approved as a new drug under section 505, certified as an antibiotic under section 507, or licensed as a biologic under section 351 of the Public Health Service Act (42 U.S.C. 262) and was, prior to such approval, certification, or license, marketed as a dietary supplement or as a food unless the Secretary has issued a regulation, after notice and comment, finding that the article, when used as or in a dietary supplement under the conditions of use and dosages set forth in the labeling for such dietary supplement, is unlawful under section 402(f); and

"(B) not include -

"(i) an article that is approved as a new drug under section 505, certified as an antibiotic under section 507, or licensed as a biologic under section 351 of the Public Health Service Act (42 U.S.C. 262), or

"(ii) an article authorized for investigation as a new drug, antibiotic, or biological for which substantial clinical investigations have been instituted and for which the existence of such investigations has been made public,

which was not before such approval, certification, licensing, or authorization marketed as a dietary supplement or as a food unless the Secretary, in the Secretary's discretion, has issued a regulation, after notice and comment, finding that the article would be lawful under this Act.

Except for purposes of section 201(g), a dietary supplement shall be deemed to be a food within the meaning of this Act.

(b) Exclusion from Definition of Food Additive. Section 201(s) (21 U.S.C. 321(s)) is amended -

(1) by striking "or" at the end of subparagraph (4);
(2) by striking the period at the end of subparagraph (5) and inserting "; or"; and
(3) by adding at the end the following new subparagraph (6) "an ingredient described in paragraph (ff) in, or intended for use in, a dietary supplement.".
(c) Form of Ingestion. Section 411(c)(1)(B) (21 U.S.C. 350(c)(1)(B)) is amended -
(1) in clause (i), by inserting "powder, softgel, gelcap," after "capsule,;" and
(2) in clause (ii), by striking "does not simulate and".

§4. Safety of Dietary Supplements and Burden of Proof on FDA. Section 402 (21 U.S.C. 342) is amended by adding at the end the following:

"(f)(1) If it is a dietary supplement or contains a dietary ingredient that -
"(A) presents a significant or unreasonable risk of illness or injury under -
"(i) conditions of use recommended or suggested in labeling,
or
"(ii) if no conditions of use are suggested or recommended in the labeling, under ordinary conditions of use;
"(B) is a new dietary ingredient for which there is inadequate information to provide reasonable assurance that such ingredient does not present a significant or unreasonable risk of illness or injury;
"(C) the Secretary declares to pose an imminent hazard to public health or safety, except that the authority to make such declaration shall not be delegated and the Secretary shall promptly after such a declaration initiate a proceeding in accordance with sections 554 and 556 of title 5, United States Code, to affirm or withdraw the declaration; or
"(D) is or contains a dietary ingredient that renders it adulterated under paragraph (a)(1) under the conditions of use recommended or suggested in the labeling of such dietary supplement.

In any proceeding under this subparagraph, the United States shall bear the burden of proof on each element to show that a dietary supplement is adulterated. The court shall decide any issue under this paragraph on a de novo basis.
(2) Before the Secretary may report to a United States attorney a violation of paragraph (1)(A) for a civil proceeding, the person against whom such proceeding would be initiated shall be given appropriate notice and the opportunity to present views, orally and in writing, at least 10 days before such notice, with regard to such proceeding.

§5. Dietary Supplement Claims.
Chapter IV (21 U.S.C. 341 et seq.) is amended by inserting after section 403A the following new section:

DIETARY SUPPLEMENT LABELING EXEMPTIONS

"Sec. 403B. (a) IN GENERAL. - A publication, including an article, a chapter in a book, or an official abstract of a peer-reviewed scientific publication that appears in an article and was prepared by the author or the editors of the publication, which is reprinted in its entirety, shall not be defined as labeling when used in connection with the sale of a dietary supplement to consumers when it -

"(1) is not false or misleading;
"(2) does not promote a particular manufacturer or brand of a dietary supplement;
"(3) is displayed or presented, or is displayed or presented with other such items on the same subject matter, so as to present a balanced view of the available scientific information on a dietary supplement;
"(4) if displayed in an establishment, is physically separate from the dietary supplements; and
"(5) does not have appended to it any information by sticker or any other method.

"(b) APPLICATION. - Subsection (a) shall not apply to or restrict a retailer or wholesaler of dietary supplements in any way whatsoever in the sale of books or other publications as a part of the business of such retailer or wholesaler.
"(c) BURDEN OF PROOF. - In any proceeding brought under subsection (a), the burden of proof shall be on the United States to establish that an article or other such matter is false or misleading.".


Section 403(r) (21 U.S.C. 343(r)) is amended by adding at the end the following:

"(6) For purposes of paragraph (r)(1)(B), a statement for a dietary supplement may be made if -

"(A) the statement claims a benefit related to a classical nutrient deficiency disease and discloses the prevalence of such disease in the United States, describes the role of a nutrient or dietary ingredient intended to affect the structure or function in humans, characterizes the documented mechanism by which a nutrient or dietary ingredient acts to maintain such structure or function, or describes general well-being from consumption of a nutrient or dietary ingredient,

"(B) the manufacturer of the dietary supplement has substantiation that such statement is truthful and not misleading, and

"(C) the statement contains, prominently displayed and in boldface type, the following: "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."

A statement under this subparagraph may not claim to diagnose, mitigate, treat, cure, or prevent a specific disease or class of diseases. If the manufacturer of a dietary supplement proposes to make a statement described in the first sentence of this subparagraph in the labeling of the dietary supplement, the manufacturer shall notify the Secretary no later than 30 days after the first marketing of the dietary supplement with such statement that such a statement is being made.".

(a) MISBRANDED SUPPLEMENTS. - Section 403 (21 U.S.C. 343) is amended by adding at the end the following: "(s) If -

"(1) it is a dietary supplement; and

"(2)(A) the label or labeling of the supplement fails to list -

"(i) the name of each ingredient of the supplement that is described in section 201(ff); and

"(ii)(I) the quantity of each such ingredient; or

"(II) with respect to a proprietary blend of such ingredients, the total quantity of all ingredients in the blend;

"(B) the label or labeling of the dietary supplement fails to identify the product by using the term `dietary supplement', which term may be modified with the name of such an ingredient;

"(C) the supplement contains an ingredient described in section 201(ff)(1)(C), and the label or labeling of the supplement fails to identify any part of the plant from which the ingredient is derived;

"(D) the supplement -

"(i) is covered by the specifications of an official compendium;

"(ii) is represented as conforming to the specifications of an official compendium; and

"(iii) fails to so conform; or

"(E) the supplement -

"(i) is not covered by the specifications of an official compendium; and

"(ii)(I) fails to have the identity and strength that the supplement is represented to have; or

"(II) fails to meet the quality (including tablet or capsule disintegration), purity, or compositional specifications, based on validated assay or other appropriate methods, that the supplement is represented to meet.".
(b) Supplement Listing on Nutrition Labeling. Section 403(q)(5)(F) (21 U.S.C. 343(q)(5)(F)) is amended to read as follows:

"(F) A dietary supplement product (including a food to which section 411 applies) shall comply with the requirements of subparagraphs (1) and (2) in a manner which is appropriate for the product and which is specified in regulations of the Secretary which shall provide that -

"(i) nutrition information shall first list those dietary ingredients that are present in the product in a significant amount and for which a recommendation for daily consumption has been established by the Secretary, except that a dietary ingredient shall not be required to be listed if it is not present in a significant amount, and shall list any other dietary ingredient present and identified as having no such recommendation;

"(ii) the listing of dietary ingredients shall include the quantity of each such ingredient (or of a proprietary blend of such ingredients) per serving;

"(iii) the listing of dietary ingredients may include the source of a dietary ingredient; and

"(iv) the nutrition information shall immediately precede the ingredient information required under subclause (i), except that no ingredient identified pursuant to subclause (i) shall be required to be identified a second time.".

(c) Percentage Level Claims. Section 403(r)(2) (21 U.S.C. 343(r)(2)) is amended by adding after clause (E) the following:

"(F) Subclause (i) clause (A) does not apply to a statement in the labeling of a dietary supplement that characterizes the percentage level of a dietary ingredient for which the Secretary has not established a reference daily intake, daily recommended value, or other recommendation for daily consumption.".
(d) **Vitamins and Minerals.** Section 411(b)(2) (21 U.S.C. 350(b)(2)) is amended -

(1) by striking "vitamins or minerals" and inserting "dietary supplement ingredients described in section 201(ff)";

(2) by striking "(2)(A)" and inserting "(2)"; and

(3) by striking subparagraph (B).

(e) **Effective Date.** Dietary supplements -

(1) may be labeled after the date of the enactment of this Act in accordance with the amendments made by this section, and

(2) shall be labeled after December 31, 1996, in accordance with such amendments.

§8. **New Dietary Ingredients.**

Chapter IV of the Federal Food, Drug, and Cosmetic Act is amended by adding at the end the following:

"NEW DIETARY INGREDIENTS

"SEC. 413. (a) IN GENERAL.- A dietary supplement which contains a new dietary ingredient shall be deemed adulterated under section 402(f) unless it meets one of the following requirements:

"(1) The dietary supplement contains only dietary ingredients which have been present in the food supply as an article used for food in a form in which the food has not been chemically altered.

"(2) There is a history of use or other evidence of safety establishing that the dietary ingredient when used under the conditions recommended or suggested in the labeling of the dietary supplement will reasonably be expected to be safe and, at least 75 days before being introduced or delivered for introduction into interstate commerce, the manufacturer or distributor of the dietary ingredient or dietary supplement provides the Secretary with information, including any citation to published articles, which is the basis on which the manufacturer or distributor has concluded that a dietary supplement containing such dietary ingredient will reasonably be expected to be safe.

The Secretary shall keep confidential any information provided under paragraph (2) for 90 days following its receipt. After the expiration of such 90 days, the Secretary shall place such information on public display, except matters in the information which are trade secrets or otherwise confidential, commercial information."
"(b) PETITION. - Any person may file with the Secretary a petition proposing the issuance of an order prescribing the conditions under which a new dietary ingredient under its intended conditions of use will reasonably be expected to be safe. The Secretary shall make a decision on such petition within 180 days of the date the petition is filed with the Secretary. For purposes of chapter 7 of title 5, United States Code, the decision of the Secretary shall be considered final agency action.

"(c) DEFINITION. - For purposes of this section, the term "new dietary ingredient" means a dietary ingredient that was not marketed in the United States before October 15, 1994 and does not include any dietary ingredient which was marketed in the United States before October 15, 1994.".

Section 402 (21 U.S.C. 342), as amended by section 4, is amended by adding at the end the following:

"(g)(1) If it is a dietary supplement and it has been prepared, packed, or held under conditions that do not meet current good manufacturing practice regulations, including regulations requiring, when necessary, expiration date labeling, issued by the Secretary under subparagraph (2).

"(2) The Secretary may by regulation prescribe good manufacturing practices for dietary supplements. Such regulations shall be modeled after current good manufacturing practice regulations for food and may not impose standards for which there is no current and generally available analytical methodology. No standard of current good manufacturing practice may be imposed unless such standard is included in a regulation promulgated after notice and opportunity for comment in accordance with chapter 5 of title 5, United States Code.".
§10. Conforming Amendments.

(a) SECTION 201 - The last sentence of section 201(g)(1) (21 U.S.C. 321(g)(1)) is amended to read as follows: "A food or dietary supplement for which a claim, subject to sections 403(r)(1)(B) and 403(r)(3) or sections 403(r)(1)(B) and 403(r)(5)(D), is made in accordance with the requirements of section 403(r) is not a drug solely because the label or the labeling contains such a claim. A food, dietary ingredient, or dietary supplement for which a truthful and not misleading statement is made in accordance with section 403(r)(6) is not a drug under clause (C) solely because the label or the labeling contains such a statement.".

(b) SECTION 301 - Section 301 (21 U.S.C. 331) is amended by adding at the end the following: (u) The introduction or delivery for introduction into interstate commerce of a dietary supplement that is unsafe under section 413.".

(c) SECTION 403 - Section 403 (21 U.S.C. 343), as amended by section 7, is amended by adding after paragraph (s) the following: "A dietary supplement shall not be deemed misbranded solely because its label or labeling contains directions or conditions of use or warnings.".

The advance notice of proposed rulemaking concerning dietary supplements published in the Federal Register of June 18, 1993 (58 FR 33690-33700) is null and void and of no force or effect insofar as it applies to dietary supplements. The Secretary of Health and Human Services shall publish a notice in the Federal Register to revoke the item declared to be null and void and of no force or effect under subsection (a).


(a) ESTABLISHMENT. - There shall be established as an independent agency within the executive branch a commission to be known as the Commission on Dietary Supplement Labels (hereafter in this section referred to as the "Commission").
(b) MEMBERSHIP. -

(1) COMPOSITION. - The Commission shall be composed of 7 members who shall be appointed by the President.

(2) EXPERTISE REQUIREMENT. - The members of the Commission shall consist of individuals with expertise and experience in dietary supplements and in the manufacture, regulation, distribution, and use of such supplements. At least three of the members of the Commission shall be qualified by scientific training and experience to evaluate the benefits to health of the use of dietary supplements and one of such three members shall have experience in pharmacognosy, medical botany, traditional herbal medicine, or other related sciences. Members and staff of the Commission shall be without bias on the issue of dietary supplements.

(c) FUNCTIONS OF THE COMMISSION. - The Commission shall conduct a study on, and provide recommendations for, the regulation of label claims and statements for dietary supplements, including the use of literature in connection with the sale of dietary supplements and procedures for the evaluation of such claims. In making such recommendations, the Commission shall evaluate how best to provide truthful, scientifically valid, and not misleading information to consumers so that such consumers may make informed and appropriate health care choices for themselves and their families.

(d) ADMINISTRATIVE POWERS OF THE COMMISSION. -

(1) HEARINGS. - The Commission may hold hearings, sit and act at such times and places, take such testimony, and receive such evidence as the Commission considers advisable to carry out the purposes of this section.

(2) INFORMATION FROM FEDERAL AGENCIES. - The Commission may secure directly from any Federal department or agency such information as the Commission considers necessary to carry out the provisions of this section.

(3) AUTHORIZATION OF APPROPRIATIONS. - There are authorized to be appropriated such sums as may be necessary to carry out this section.
(e) REPORTS AND RECOMMENDATIONS. -

(1) FINAL REPORT REQUIRED. - Not later than 24 months after the date of enactment of this Act, the Commission shall prepare and submit to the President and to the Congress a final report on the study required by this section.

(2) RECOMMENDATIONS. - The report described in paragraph (1) shall contain such recommendations, including recommendations for legislation, as the Commission deems appropriate.

(3) ACTION ON RECOMMENDATIONS. - Within 90 days of the issuance of the report under paragraph (1), the Secretary of Health and Human Services shall publish in the Federal Register a notice of any recommendation of Commission for changes in regulations of the Secretary for the regulation of dietary supplements and shall include in such notice a notice of proposed rulemaking on such changes together with an opportunity to present views on such changes. Such rulemaking shall be completed not later than 2 years after the date of the issuance of such report. If such rulemaking is not completed on or before the expiration of such 2 years, regulations of the Secretary published in 59 FR 395-426 on January 4, 1994, shall not be in effect.


(a) IN GENERAL. - Title IV of the Public Health Service Act is amended by inserting after section 485B (42 U.S.C. 287c-3) the following:

"SUBPART 4--OFFICE OF DIETARY SUPPLEMENTS SEC. 485C. DIETARY SUPPLEMENTS.

"(a) ESTABLISHMENT. - The Secretary shall establish an Office of Dietary Supplements within the National Institutes of Health.

"(b) PURPOSE. - The purposes of the Office are -

"(1) to explore more fully the potential role of dietary supplements as a significant part of the efforts of the United States to improve health care; and

"(2) to promote scientific study of the benefits of dietary supplements in maintaining health and preventing chronic disease and other health-related conditions."
"(c) DUTIES. - The Director of the Office of Dietary Supplements shall -

"(1) conduct and coordinate scientific research within the National Institutes of Health relating to dietary supplements and the extent to which the use of dietary supplements can limit or reduce the risk of diseases such as heart disease, cancer, birth defects, osteoporosis, cataracts, or prostatism;

"(2) collect and compile the results of scientific research relating to dietary supplements, including scientific data from foreign sources or the Office of Alternative Medicine;

"(3) serve as the principal advisor to the Secretary and to the Assistant Secretary for Health and provide advice to the Director of the National Institutes of Health, the Director of the Centers for Disease Control and Prevention, and the Commissioner of Food and Drugs on issues relating to dietary supplements including -

"(A) dietary intake regulations;

"(B) the safety of dietary supplements;

"(C) claims characterizing the relationship between -

"(i) dietary supplements; and

"(ii)(I) prevention of disease or other health-related conditions; and

"(II) maintenance of health; and

"(D) scientific issues arising in connection with the labeling and composition of dietary supplements;

"(4) compile a database of scientific research on dietary supplements and individual nutrients; and

"(5) coordinate funding relating to dietary supplements for the National Institutes of Health.

"(d) DEFINITION. - As used in this section, the term "dietary supplement" has the meaning given the term in section 201(ff) of the Federal Food, Drug, and Cosmetic Act.
"(e) AUTHORIZATION OF APPROPRIATIONS. - There are authorized to be appropriated to carry out this section $5,000,000 for fiscal year 1994 and such sums as may be necessary for each subsequent fiscal year."

(b) CONFORMING AMENDMENT. - Section 401(b)(2) of the Public Health Service Act (42 U.S.C. 281(b)(2)) is amended by adding at the end the following:

"(E) The Office of Dietary Supplements.".

Since DSHEA was passed into Law

The DSHEA law was enacted because consumers were outraged when the US Congress moved to remove consumer access to nutritional supplements. Public furor mobilized Congress to passed DSHEA with what appeared to be unanimous Congressional consent.

Contrary to popular belief, in 1994 DSHEA did not pass by a unanimous vote on the floor of the House and the Senate. According to Loren Israelsen and Thomas D. Aarts in an article published in Nutrition Business Journal entitled “DSHEA Ten Years Later: Now What?”, no floor vote on DSHEA was ever held in the House. In fact, they say, that the House version of DSHEA never even made it out of committee. DSHEA became law because of a "perfect storm" confluence of political forces.

Israelsen and Aarts said that the Gingrich New Deal Republicans were about to sweep out the old line House Democrats who were holding up DSHEA, which caused the Democrats to unload the DSHEA issue at the very last minute to save their jobs. In the Senate, Senator Orrin Hatch (R-UT) was able to hold off a last minute attempt to derail DSHEA as it was coming up for unanimous consent vote in the closing minutes of the 1994 Senate session.

Literally, DSHEA was a political "Hail Mary" of unprece-dented proportions. Apparently, frantic last-minute deal making resulted in the addition of the structure/ function claim disclaimer, among some other last minute changes.

Since passage in 1994, the industry has pacified itself into believing that DSHEA was an overwhelming political victory (indeed, it was) because it was unanimously voted for by the Congress (which it was not). As DSHEA was created by last minute deals, other last minute deals is the way of the political process.
Since DSHEA was passed into Law

By making DSHEA the global standard, the economics of countries can be impacted. In the US alone, delaying the onset of Alzheimer's Disease just one year can save the nation four hundred fifty billion dollars ($4,500,000,000) in assisted care costs for just Alzheimer's Disease patients.

Many deadly diseases could be eliminated from the planet by making DSHEA the standard for nutrients. DSHEA is a unique pro-health US law that treats nutrients as foods, which indeed they are. Nutrients are safe and effective and have important clinical impact in preventing, mitigating, treating, and curing diseases from under-nutrition.

DSHEA is the counter to the pro-illness impact of standards and guidelines of Codex. Perhaps the greatest single impediment to advancing health to the world is the Codex Alimentarius Commission (CAC, or Codex). The restrictive Codex Vitamin and Mineral Guideline (VMG, ratified July 4, 2005, Rome) treats vitamins and minerals as toxins whose upper limits must be determined by "risk assessment" (RA), a technique used in toxicology to determine the highest dose of a poison that can be given to a human being without any discernible impact. The VMG limits upper doses of nutrients to levels that do not exceed those found in unprocessed food. Since ubiquitous and specific toxins increase the need for nutrients, this short-sighted and dangerous Codex text both mandates and institutionalizes deadly levels of under-nutrition.

Codex employs a double standard that favors corporate interests by permitting extraordinarily high health-adverse levels of dangerous toxins like pesticides, veterinary drugs, synthetic growth hormones, heavy metals, preservatives, and food additives.

Many of Codex's more than 5,000 standards and guidelines degrade the integrity of the food supply and health. Two groups, The Natural Solutions Foundation and Citizen's Codex Working Group, have crafted a comprehensive strategy that allows nations to protect their people from toxins and under-nutrition while avoiding World Trade Organization (WTO) trade sanctions.
Since DSHEA was passed into Law

What they call, the "Codex 2-Step," can be applied by pro-health countries to any of the damaging or dangerous standards and guidelines promulgated by Codex. Once a country has adopted a revised and more scientifically valid standard or guideline than that required within a Codex text (Step 1), it must then enact national legislation to make revised standard or guideline becomes national law (Step 2). Having carried out the required two-step process, the country is then free to engage in the manufacture and trade (including export) of items that would otherwise be prohibited by the Codex standards and guidelines. For example, the sale of high-potency nutritional supplements permitted under a DSHEA-type law currently violates the restrictive and deadly Codex VMG. The Natural Solutions Foundation helps countries establish access to unlimited amounts of dietary supplements at their discretion by establishing the principles of DSHEA globally.
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