QUANTITATIVE MEDICINE

A DEFINITIVE GUIDE TO GETTING WELL STAYING WELL AVOIDING DISEASE AND SLOWING AGING

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QUANTITATIVE MEDICINE

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PART I - CONTROLLING YOUR HEALTH

HOW YOUR BODY CAN PREVENT DISEASE AND AGING

1 - DEGENERATIVE DISEASE

There is no need to die from age-related diseases, yet 70% of us do. Included here are cancer, adult onset diabetes, heart disease, dementia, and several others. Sometimes these are called degenerative diseases, sometimes chronic diseases.

We can completely prevent all of these. We can reverse most of them. The tools are all there, inside each of us. Evolution gathered them for us. Evolution is continually at work, remodeling all of life, discarding items that proved useless, retaining those that aided survival. At this point we have amassed an enormous collection of healing and repair processes. There are those that repair DNA which date all the way back to bacteria. Processes fighting cancer are found in the earliest animals. The ones cleaning arteries emerged with the appearance of the vertebrates, a relatively recent development. In the countless eons of our past, this diverse and complex collection of repair and replacement processes has accumulated—layer upon layer. But what to call it? It's no single system, but an evolutionary parade of healing mechanisms and processes that began with the inception of life itself.

This collection is far more powerful than any drugs or surgeries conjured up by our wizards of medicine. For those whose habits or actions engage these processes, age-related diseases rarely occur, and aging itself is slow. These people don't get sick. They stay energetic and healthy, with fewer aches and pains and more exuberance. But they are the minority. For most of us it isn't working. All these disease prevention mechanisms and processes are failing. They are not preventing degenerative disease.

What went wrong?

Any living thing is the accumulation of that which went before, and we are, of course, strongly adapted to the human condition, or rather, what it had been for the last few million years. Evolution, however sure, creeps forward with a glacial step. It deals poorly with abrupt change, which is unfortunate, because the agricultural revolution, which began only 10,000 years ago, so thoroughly upended our lifestyle that we have only begun to catch up.

What began then, eventually spreading worldwide, was an abrupt shift from a million-year history of an irregular protein and fat diet, a life involving fierce bursts of activity, to a new type of starch-based diet, and a sedentary, though arduous, sort of life. In the preceding million years, we had successfully endured a huge confusion of ordeals and misfortunes, and were well adapted to deal with any of them, but the changes that arrived with the agricultural revolution were new, never seen before, and our wonderfully evolved health management systems and processes didn't know what to do with them—*and they still don't.*

This should be an era of ease and plenty. And in many ways it is that, but a strange paradox intervenes and casts an unexpected gloom: *all this abundance and ease convinces our body that it should prepare for a famine*. We will shortly explain the survival logic at work here, but as part of this famine preparation, all "unnecessary" processes are shut down, including much of the degenerative disease prevention. This has the unintended consequence of opening the gates and giving these diseases free rein.

This is certainly an odd and unfortunate conclusion for our body to reach. How could unprecedented wealth and ease take such a sinister turn?

In all of us, there is a survival point of view operating behind the scenes, forcing a life script we cannot escape. It holds us to its ancient logic, a logic driven by survival, and despite the obsolescence of such primordial concerns, the unseen parts of us that manage energy and healing still heed the rules and remnants of those times long past.

Simply put, our body thinks we're starving, or about to. And its logic? We aren't doing the right things: we aren't hunting or gathering. Worse, we are eating food that normally would become available only before the cold, lean winter. The agricultural revolution immersed us quite suddenly into this new mode of life, and our body—the unseen part that manages energy and healing—is only just beginning, after all this time, to sort it all out.

Impressed firmly in our inner clockworks are certain constant rules, etched there by millions of years of life experience:

- To get food, you must hunt or gather. If you aren't doing this, the logical reason is that there is no food available.
- If you are getting anything sweet or starchy, it is late summer and a cold and hard winter lies ahead.

With food running out and winter approaching, perhaps an ice age one, survival is key. Best to store the immediate food supply as fat. Reduce energy levels. Put off anything that can wait for a time of plenty. Put off repair, healing, and replacement. Save these for another day.

The agricultural revolution has become the agricultural institution and we can never return to the old ways, nor would most of us want to. But can we construct a link back to the prior health? Can we convince our archaic inner processes to use the energy we consume to heal, and not store it as fat? Convince it to enable again all these powerful repair mechanisms? The answer is yes, and Quantitative Medicine will show how.

THE NATURE OF DEGENERATIVE DISEASE

Infectious disease involves an invader—a virus or bacteria perhaps. It invaded via a cut or by eating bad food, and then spread. The immune system fights back, usually successfully. Once the disease is fought off, the invader is gone, having been fully annihilated.

Degenerative diseases are different. They are occurring continuously, starting from birth. The immune system fights them as well, but it's not always clear who has the upper hand. These diseases have a tipping

[. . .]

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better in numerous other subtle ways. Try it. Above all, do what it takes to get your stress level down.

4. Tune in to your circadian rhythms. Our Paleolithic ancestors were locked into the hours, lengths, and colors of the days. This foretold the coming seasons and initiated the substantial metabolic changes needed to survive them. Did we know how to hibernate back then? Not exactly, but we certainly have many of the requisite abilities. A long and severe ice-age winter requires an ability to quickly store a lot of fat and to down-regulate energy expenditures. Does this ring any bells? It likely still rings a few in our hypothalamus, which has these expectations hard-wired in. If we violate them, are there consequences? The is surely the case. Seasonal Affective Disorder is connected to this, and shift workers have significantly higher rates of cancer. In any case, sleep well. Quality sleep is best. Seven *solid* hours is probably enough. Nine is even better. Be sure to make it dark and quiet. Tape over all those red lights from your electronic gadgetry. Perhaps your sleep patterns do need to vary with the seasons. Pay attention to sleep. A lot of repair and renewal goes on during sleep. Make it count.

Do you need to do these things? We don't know and neither does anyone else. We suggest them because first, they are common problems, and second, they won't hurt you. No one needs sugars and starches. Exercise is universally beneficial, and quieting your mind is always healthy. If you want to refine this, you can get a lot more benefit, but you will have to measure and go from there. That is the topic of PART II and PART III.

GUIDE TO THE BOOK

Hopefully, PART I answers the "what" of Quantitative Medicine.

There are two more principal parts:

PART II - USING QUANTITATIVE MEDICINE (the "how")

PART III -THE SCIENCE OF QUANTITATIVE MEDICINE (the "why")

You can stop after PART II. Should you go on? Read this paragraph:

> *Life span amongst mammals is generally proportional to weight. Mice live about 2 years and elephants as much as 70. We are exceptions, as are our primate cousins, living longer still. However, there is a very small mammal with a very revved up metabolism that represents a far greater exception. This animal is lighter than a mouse but consumes several times as much food daily. Whereas a mouse may live 2 years, this animal—the common bat if you haven't already guessed—lives 25. What is the bat's special trick? Well it's not the 100% bug diet, it's flying. Flying means being able to summon up a huge burst of energy. This means a very modified metabolism, and this modification also gives the bat (birds too) an extraordinarily long life for its weight. The modification lies in tiny sub-cellular organelles called mitochondria. These organelles were once free bacteria and were enslaved by our single-celled ancestors perhaps a billion years ago. Mitochondria still have their own DNA. They create energy from glucose and fat. The more mitochondria you have, the more energy you can conjure up, and the slower you wear out. We all have some mitochondria, but bats have a lot more. This has serious implication for us. If we can improve our mitochondrial function, it can have a profound effect on….[and so on]…*

Now take this "quiz": Did this interest you? Could you follow it? Then read PART II and then go on to PART III. No advanced degree required. B's or better in high school science and an inquisitive mind are useful, especially the latter.

Did this seem like a needless digression? Would you rather get straight to the point? Do you have better things to do? Then just read PART II, which won't be diving as much into technical detail. This is not to say it is in some way easier or dumbed down, just less technical.

There are also various appendices, including an annotated bibliography of medical research papers.

Quantitative Medicine is a complete medical system for preventing degenerative disease. It began 20 years ago, largely as an investigation into the various reasons standard medicine wasn't making people well. (In fact, in a lot of cases, it was making people worse.) It became a synthesis of what is known about the cause and prevention of degenerative disease.

Some of the material is common knowledge, some has been known and ignored for decades, and some is new. Its effectiveness has already been proven on a diverse cohort of over 2,000 patients. Effectiveness is largely a matter of compliance, which is to say application of willpower, self-discipline, or just plain old-fashioned gumption.

If you are stopping at PART I, thanks for dropping in, and come back if you need to go further. Good luck.

Key Points

4 - Measurement and Modification

- We are too genetically diverse to know our own health.
- A blood draw and full-body scan will elicit considerable information.
- The hypothalamus doesn't know if you are actually hunting, or emulating something like that at the gym.
- If you eat mostly what you, in principle, could have hunted or gathered, the hypothalamus will make good use of it.
- Starches and sugars have little nutritional value and we are ill equipped to deal with them. They weren't in the Paleolithic diet.
- In any case, your health will not deteriorate, and will likely improve, if you 1) cut down on sugar and starches, 2) turn up the intensity of your exercise, 3) undertake a meditative activity, and 4) get quality sleep.

PART II - USING QUANTITATIVE MEDICINE

QUANTIFYING THE HEALING AND REPAIR PROCESSES

5 - PREPARATIONS

Welcome to **PART II**, which guides you through the whole process of self-quantification and determination of your optimum healthy lifestyle. Included are how and what to measure, how to interpret the results, and if needed, which modifications are most likely to improve them. Do it and you are on the path to a long, disease-free life. Heart disease, cancer, adult onset diabetes, Alzheimer's, osteoporosis, and other degenerative diseases can largely be avoided.

PART II stands alone. It is a complete guide to degenerative disease prevention and recovery. It is the "how to" of the Quantitative Medicine method. "Why" it works is found in PART III.

THE QUANTITATIVE MEDICINE PROCESS

Normally a doctor will order blood tests and scans of various sorts, often as part of an annual physical. Interpretations of the results vary widely. Many simply check that the numbers are within some acceptable range. In fact, often the "normal" ranges that are shown on the blood work results are literally that: the range of the numbers the blood analysis lab typically sees, and not a medically relevant OK/not OK classification at all.

Many doctors are unaware of ideal homeostatic set-points, the body's feedback mechanisms, anabolism indicators, and their importance to health. This information can be pieced together from the medical literature, but it is rarely taught specifically in medical school. When it is, it is usually called

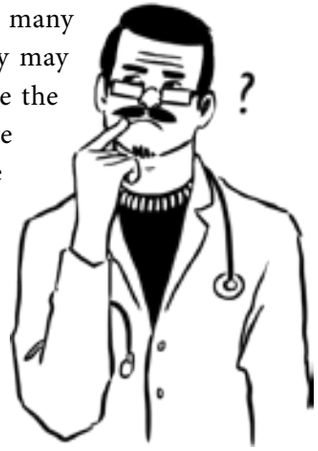
"Lifestyle Medicine," but even there, the Quantitative Medicine "measure and modify" feedback methodology is missing.

Though possible, it is not advised or even desirable to pursue the Quantitative Medicine lifestyle changes without your doctor. But even with your doctor on board, you are, in a sense, taking matters into your own hands. The day you turn up at your doctor's office asking for a requisition for the 16 or so blood tests we recommend, you will likely find you have a confused physician on your hands. Hypochondriacs excepted, having the patient wanting to order additional tests is a bit off the standard medical track.

Dealing with Confused Physician Syndrome (CPS)

Explain exactly what you are doing and why. Other than paying for them, there is no potential harm in getting all these tests, and of course, there are many substantial benefits. Indeed, the measurements could indicate a serious problem. You will want to work with your doctor for any such thing as that. Second, your doctor knows you and can facilitate your proposed transformation, or should anyway.

Chapter 7 lists the tests, along with strategies for dealing with potential costs. So get the blood draw and scan prescriptions and so on, but analyze the results with the doctor, using this book. Discuss what you intend to change and why. There is no logical reason any doctor should have major objections to all this. Actually, they ought to be very interested. They can do better doctoring by adopting these techniques. They too can (and should) practice Quantitative Medicine. CPS is usually curable.



Logical or not, it goes without saying that many doctors won't see things quite this way. They may have the attitude that they and they alone are the keepers of your health. They may discourage the whole approach. A very typical response might be to disregard any numbers that aren't notably problematic and recommend more exercise and less saturated fat. They may try to put you on statins. This response corresponds to an internal doctor thought process that goes something like this: "This patient is not in serious trouble now,

maybe the statins will slow the inevitable, maybe he will follow the exercise and dietary advice. Unlikely. Little else to be done. We'll wait for something more serious and hope for the best."

This could be called "standard practice," and if you accept as a given that people won't change, it may indeed be the best advice. However, if you are reading this book, then clearly this is not the kind of medical advice you are seeking When you elect to use Quantitative Medicine, you are taking personal control of your health, and you can bring about substantial improvement by doing so. The method is familiar. It is about health measurement and lifestyle modification.

DOCTOR SHOPPING

Perhaps you do not have a doctor who knows you and whom you regularly see. Or you may have been using a walk-in clinic, or could have relocated. Or perhaps you do have a doctor, but he or she rejects or denigrates the Quantitative Medicine principles. If you feel a change would be appropriate, here are some search tips.

First and foremost, choose a doctor with whom you can communicate, with whom you feel comfortable. If you feel the doctor is not engaged in your issues and concerns, or has an overloaded schedule, you may need to move on.

Bear in mind that a doctor may have over a thousand patients, most of whom are seen once or twice a year. It is not necessarily reasonable to expect genuine engagement with every patient, but if the doc shows interest in your proposed program, he will probably become quite involved in your own quest.

But try to push beyond "curious medical observer" and find one that will embrace the principles of Quantitative Medicine, at least provisionally. It is always a good sign if the doctor participates in your investigation of possible measurement-driven lifestyle changes. Will he or she be a detached observer or a co-conspirator? Seek the latter.

Ask the doctor his or her ideas on heart disease prevention, cancer prevention, diet, and the like. Get an idea how they tick. Are they mired in the past or open to new ideas? Probe around.

STANDARD PREVENTIVE MEDICINE ADVICE

Normally it's these four words: "Eat right and exercise." This advice is slung around so casually that it has lost any meaning it may have had. But the four words beg the questions: what should I eat and what sort of exercise must I do? And here is where the troubles really begin. High up on the list of recommendations will likely be found the words "whole grain" and "aerobic." Any advice advocating either of these in any form is a sure sign of belief-based BAD MEDICAL ADVICE. Fact-based reasoning is rare enough in many medical realms, but almost wholly absent in nutritional and exercise recommendations. Neither are taught in medical school, and both are subject to huge cultural and business influences.

Here's a good place to raise your hand and ask a few hard questions. If your glucose is too high, and your doc says eat whole grain and take 45-minute brisk walks daily, you may want her to explain exactly why that is going to help, because as you will soon learn, grain (whole or not) is a likely *cause* of high glucose, and brisk walks aren't going to have any effect on it.

There is no universal best diet. There is a diet that is best for you, but unless you match diet, exercise, and other changes to your specific needs and deficiencies, there will be little improvement. Things may even get worse. The big surprise is that if you do match them, you can make enormous improvement, enough to make an immediate difference,

as well as a substantial long-term benefit. Enough to prevent and even reverse degenerative disease. Enough to extend a healthy life. These are the astounding benefits of Quantitative Medicine.

This slowing of aging and blocking of degenerative disease is achieved by giving your hypothalamus free rein to achieve ideal homeostasis and to put you in an anabolic state. These catalyze renewal. Homeostatic misalignment is the root cause of all degenerative disease. In this sense these diseases are all the same.

You, the conscious you, will need to provide an environment that will facilitate this, but to get started, you must resolve four unknowns:

- First, how do you know which parts of you need fixing? Which are in homeostatic alignment and in an anabolic state, and which are not?
- Second, if you need to change something, what, precisely, do you change?
- Third, what will be easy and what will be hard?
- Fourth, how will you know when you've gotten there?

Quantitative Medicine will provide the missing links, or rather show you how to provide them for yourself. To determine which changes might be needed, you have to measure hormones, biochemicals, and the like with blood tests, and take a look inside with a scan. There are known ideal levels, and if these aren't met, they will indicate a direction to take. At this point, you can choose to accept this. It's not an impossible mission, and further, you can make a change, get another blood test in three months, and see if it worked.

To quantify homeostatic alignment and anabolism, we will focus on these five groups of numbers. Get these right, and your rate of aging will be slow and your risk of degenerative disease low.

- Sugar/Starch Management - how well do you metabolize these two?
- Lipid Management - your risk of heart disease. How is your hypothalamus managing fat?
- Stress Management - are you under physiological or psychological stress? Is this impairing your health?
- Anabolism - is your body spending time in anabolic mode, renewing and repairing at the cellular level?

- Organs, Iron, and Bones - are your liver and kidneys working right? How is your iron storage? What is your risk of osteoporosis?

For some of the population, all of these are OK. These lucky people needn't change their lifestyles. For most people, several of these areas will be OK, which then suggests a focus on just the one or two that aren't. For some people, there will be broader problems, which will call for broader solutions.

Depending on your specific results, various changes will be proposed. These will include diet suggestions, exercise suggestions, and stress reduction methods. After all is said and done, you should be eating a delicious diet, but possibly with some of your old favorites gone, exercising vigorously a couple of hours a week in a very specific way, and doing some sort of stress reduction. This would be a typical program. The specifics would be determined from your actual test results.

Summoning up the willpower, drive, gumption, self-discipline, resolve, or whatever you wish to call it, is entirely your affair. You will have your style. You can tiptoe in or take the plunge. If you do *some* of it, you will get *some* of the results, which is always better than none. Plus, this isn't some sort of makeover or rehab. If you have to make changes, you probably have to make them for the rest of your life. So you need to have the wisdom to make changes you can actually stick with; that you are willing to tolerate long-term.

Along the way, you are going to learn a lot about how the body works and a lot about degenerative diseases, both its causes and cures.

Key Points

5 - Preparations

- You may encounter skepticism on the part of the health care providers. Persevere.
- Measurements will indicate how close you are to ideal homeostasis and how anabolic you are.
- Measurements has been divided into four groups—glucose management, lipid management, stress and inflammation management, and anabolism—with a fifth group for several other individual measurements.

6 - WHAT YOU ALREADY KNOW AND ITS IMPORTANCE

You are already partly "Quantified." You know certain things: your weight, blood pressure perhaps, cholesterol, possibly more. This is a start, but unfortunately these common numbers are, in most cases, badly misinterpreted, as you will soon see.

YOUR "WATE" AND FATE

These machines were once ubiquitous, costing only a penny, but offering mostly non-medical fates. However, attempts to predict health from body weight go back at least 150 years to the Body Mass Index or BMI. There are innumerable (and identical) BMI calculators found on the internet. By entering your height, weight and sometimes your sex and age, your BMI will be computed, and you will often be sorted into a thin, normal, overweight, obese, or *really* obese category. Normal is 18-25, overweight is 25-30, and so on. Now as measures go, BMI is a really lousy one. What is a lot more important is the percentage of that weight that is muscle, and (not unrelated) your waist measurement. But lousy or not, a large amount of medical advice is dispensed based on BMI, and a surprisingly large amount of medical research has been conducted connecting it with expected mortality.

Now here's where it gets really interesting, or maybe odd is the right word. Virtually all the medical *authorities* say that the ideal, healthiest BMI is the "normal" range, 18-25. However, virtually all the medical *research* says the healthiest BMI is "overweight." Really! For men the best BMI number is around 27 and for women around 30. This is well into the "overweight" range. There is a 15 to 40 pound difference between "normal" and the ideal "overweight." How can overweight be best? Well, again we have (another) case of doctors appearing to ignore their own research. What is going on here? The doctors are advising a BMI 15 to 40 pounds lower than their own researched optimum. That many pounds is quite a lot to lose, as most of us can attest. Why the disconnect? Here are some possible reasons:

- Doctors watch too much TV. We learn from TV that one notch up from emaciated is ideal.
- The published advice is lagging behind the research. Could be, but some of this BMI research is 15 years old.
- Moral hazard. A medical profession favorite. As soon as we, the general public, learn overweight is best, we are going to pig out and end up very obese. Possibly, but after all, are we really that stupid…?

Does this mean you should plump up? Not really. The overweight health advantage, though real, is quite slight. We will be exploring many other factors that make huge health differences. The real message is that quite a broad range of weights are healthy. For a 5' 10" male 130 to 210 pounds is likely OK; for a 5' 6" woman, a weight of 115 to 185 is in the "don't worry about it" zone. If your weight is changing for no reason, up or down, worry about that.

So what is important weight-wise? It's simple enough. Belly fat is bad. Other fat is not bad. Muscle is good. Don't worry about fat for now. If you are in some sort of dangerous area, too fat or too skinny (which can be dangerous too) the numbers will show what is amiss and will also indicate the best lifestyle changes. Starvation dieting and marathon brisk walks are not going to be among them.

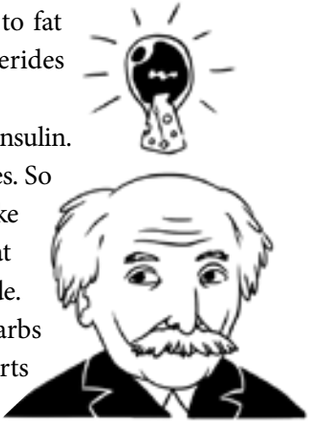
THE GRAND UNIFIED THEORY OF FAT

You have heard by now that fat doesn't make you fat, carbs make you fat, which seems confusing. Why wouldn't fat also make you fat? Rarely is a cogent answer supplied for that one. Here's the answer.

The amount of fat you have is regulated to an ideal homeostatic set-point by our dear friend and master controller, the hypothalamus. If you have more fat than it thinks appropriate, it will burn it. If you have less, it will add fat. If the hypothalamus thinks you need more fat, it will convert everything you eat to fat: carbs, fat, and even protein. It will regulate you to a level it thinks is appropriate—not fat, not skinny.

Fine, you think, so if fat is regulated, why does anyone ever get fat?

Well, there's a catch, and it's a big one. If insulin is high, this hypothalamic fat regulation apparatus is shut down, and fat is stored, not burned. This includes both the carbs you just ate and any fat or protein you consumed as well. It's all converted to fat and stored. Circulating fat in the form of triglycerides will also pile up in your blood.



But fat and protein by themselves don't raise insulin. Glucose—meaning carbs—is the only food that does. So this is why carbs, especially sugar and starch, make you fat. They increase your insulin, block the fat regulation, and basically put you in a fat storage mode.

If you are a kid and can metabolize all those carbs without running up your insulin, then these sorts of dietary habits won't make you fat. That's why kids can get away with that sort of thing, but if those kids eat enough carbs, you get the childhood obesity epidemic.

This hypothalamic regulation is why the Atkins diet works well at first and also explains why there is no more weight loss after a few months. Atkins is a very low-carb diet. This causes the insulin to drop, which allows the hypothalamus to regulate the fat to its desired level. If there is excess fat, it will burn it off quite quickly. It actually burns it. An Atkins dieter will feel hot and sweaty. This burning of fat yields the rapid weight loss this diet is famous for. As soon as the fat has burned down to the ideal hypothalamic reference level, fat is regulated. No more weight loss or gain.

With today's social pressure to be forever skinny, many will not be pleased with the fat level their hypothalamus has chosen for them. Eating less will not work well. Your hypothalamus will fight it tooth and nail. It will lower your energy level, your mental acuity, your creativity, your immune system, your cellular repair level, anything to hang on to that precious fat. You will be irritable, anxious, and depressed. If you starve yourself enough, you can lose more weight, but you will effectively become a zombie.

Why is the hypothalamus so enamored with fat? And why does it shut down the fat burn when we eat a bunch of carbs?

Fat is your reserve fuel. As far as the hypothalamus is concerned, we are all still hunter-gatherers. If we run out of food, that stored fat is our lifeline. So it will let other stuff slide in order to hold on to it. But why does it let the carbs derail the regulation process? Recall that hunter-gatherers ate little or no starch, maybe some honey when they lucked into it, and fruit in season.

This meant carbs were a summertime thing. Since a long ice age winter was soon to follow, it made sense to store up all that sugar as fat. So that's what it does. The hypothalamic set-point for the fat storage is largely genetic. The northern hunter-gatherer populations needed better fat preservation skills. Though of little benefit now, many of us wouldn't be here if our ancestors hadn't had this ability.

BLOOD PRESSURE

This also hasn't a lot of diagnostic value, though high blood pressure is a risk factor for heart disease and should be dealt with.

The conventional medical wisdom among many doctors (sometimes more weightily called "standard practice") has been that anyone with a blood pressure over 140 should be on statins. Some say anyone over 50 years old should be on statins, and some have even proposed them for children. Finally, there is one doctor who has advocated adding statins to the drinking water. (His actual name: Dr. Reckless.)

Other drugs are usually prescribed with the statins, the most common being beta-blockers and ezetimibe.

Here is what the Mayo Clinic has to say:

- If your blood pressure is below 120/80, fine.
- If above 120/80, but below 140/90, it's "Pre-hypertension," and drugs are not recommended.
- Above that, but below 160/100, it's "Stage 1 Hypertension." Try to reduce it with a lifestyle change and failing that, consider drugs.
- Above that, do a lifestyle change and "discuss" taking medication with your doctor.

As far as drugs go, the Mayo Clinic doesn't seem to be in any hurry to pull the trigger. Why then are so many doctors writing endless prescriptions for hypertension? Here, Mayo is perhaps reflecting more recent research, which appears to rather sharply limit the groups of people that benefit from these drugs. Normally, these drugs are specifically targeted at some cardiac risk factor. They may well reduce that risk, but apparently this comes at the expense of other problems. In particular, most of the drugs, singly or in combination, do not appear to lower all-cause mortality for most groups, and for some combinations, there is an increase in death rate.

High Blood Pressure Is Not the Disease

The additional drugs frequently tossed into the mix usually do no good and some harm. The general reason for this is simple: high blood pressure isn't the disease, it is a symptom. The body is raising blood pressure for a reason, such as ensuring that blood gets where it is needed. In most cases, high blood pressure is due to clogged arteries, and the right "medicine" is to unclog them. Unfortunately, neither statins, nor ezetimibe, nor beta-blockers, nor any of the other commonly prescribed meds, reduce the clogging—arterial plaque. The cure is diet and exercise of the right sort, and stress reduction.

However, there are categories of people with dangerously high blood pressure, say 180/110 or higher, that need immediate treatment. Levels this high need to be brought down, but this should be looked upon as an interim measure: something to bridge the gap till lifestyle change can solve the underlying problem.

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- **LDL particle size.** A predominance of small LDL particles causes heart disease. The size is determined by diet and exercise, but also genetically. Again heart-healthy practices can counteract this.
- **Homeostatic weight.** If you are on a low-carb diet and exercise, your body will regulate to the weight that your hypothalamus thinks is your healthiest. Further weight loss is difficult. The specific level is largely genetic.
- **MTHFR**. A deficiency of this could result in high homocysteine. Homocysteine is a toxic breakdown product of the essential amino acid methionine. Stress and poor diet also raise homocysteine.

See the specific sections or the index for details on these conditions.

Needless to say, there can be numerous other situations affecting overall health that are genetic in origin. Genetic information should be used to advantage, and not as an excuse. For instance, a tendency to store starch and sugar as fat is common and is an adaption to the realities of northern seasons. This doesn't mean that starches must be avoided, or that such weight gain is inevitable. It means only that the levels of the hormones that control all this must be frequently measured and tightly managed. If this is done, the problem can be controlled. Of course, more discipline will be needed.

Genetics can work in you favor as well. Things may turn up indicating that there are certain problems you will never have to worry about. So don't shun genetic information, but use it wisely and sensibly.

Key Points

6 - What You Already Know and Its Importance

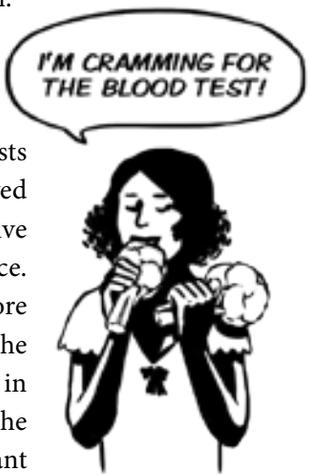
- Weight in general and Body Mass Index (BMI) in particular are poor predictors of health.
- "Overweight" is the healthiest weight, though its advantage over "Normal" and "Obese" are slight.
- Normally a weight 20-40 lbs. lighter is recommended by the medical profession.
- Hypertension (high blood pressure) below 140 does not need to be treated with drugs, including statins.
- Total cholesterol is a practically useless measure. More important are certain types of LDL cholesterol and certain types of HDL cholesterol.
- If you have very few of the small LDL particles, your heart disease risk will be low regardless of your overall cholesterol.

7 - STEP I - TESTING

QUANTIFYING YOUR HEALTH

Health is measured with scans and blood tests. Unless there is a problem, scans would be done infrequently: every couple of years. Blood tests, though, should be done more frequently, some quarterly. There are five categories of blood tests to be considered:

- Tests done only once.
- Tests done in response to a specific symptom.
- Tests done annually.
- Test done twice a year.
- Tests done quarterly.



This may mean, initially, that quite a few tests should be done. There may be some expense involved depending on a variety of factors. Quantitative Medicine is not completely covered by most insurance. More on that later. The test list will evolve. Before diving in, consult QuantitativeMedicine.net for the latest list (and pricing). Enter "Blood Test Panels" in the search box. The availability and usefulness of the various tests are moving targets. Several important tests are no longer available. The reasons for this are unknown, but almost surely financial. We hope they return, along with some useful new ones. Good health depends on good testing.

Tests Done Only Once

These tests tend to indicate things you either do or do not have, but if you have them, you are basically stuck with them. So why bother? These particular tests mean certain risks. For instance, high Lp(a), a cholesterol variant, significantly increases the risk of heart disease. It's genetic and around 10% of the population has it. There is currently no cure, but having it doesn't mean you are condemned to get heart disease, You are predisposed to it though. By adopting lifestyle practices that reduce heart disease risk, you can effectively counteract high Lp(a).

You might already have had these tests. If so, there is no need to repeat them. Here is the list of do-once tests:

- **Lp(a)**. Already mentioned, Lp(a) is a lipoprotein (cholesterol) variant that increases heart risk. About 10% of the population is at risk. See the "Is Your Lp(a) High?" section in chapter 9 for details.
- **APO-E4**. Apolipoproteins are a family of proteins that coat LDL, HDL, and chylomicron particles in order to make them water soluble. The APO-E4 subtype is a strong risk factor for Alzheimer's. See "Do You Have the APO-E4 Variant?" in chapter 9 for details. Again, the best way to fight it, indeed, the only way, is through heart-healthy practices, and knowledge of its presence provides strong motivation. Normally this test is ordered after it is too late. Caught early, the risk can be substantially reduced.
- **TTG and Gliadin Antibodies - Gluten Intolerance.** Gluten intolerance is a severe reaction to gluten, found primarily in wheat. In the extreme, it is called celiac disease. Some cannot digest wheat at all. The solution is simple though: cut out wheat and other glutens. See "Are You Gluten Intolerant?" in chapter 9 for details.

Though pricey (~$200 for the lot), these tests need not be repeated.

If either APO-E4 is present or Lp(a) is high, a serious lifelong discipline will be needed comprising a strict diet and strenuous exercise program. It's bad luck to have these, but by acting now, the consequences can be avoided. A strict diet and strenuous exercise program, if begun early, will prevent just about every other degenerative disease too.

Tests Done Once and in Response to a Specific Symptom

Some tests should be done once and also if a problem is suspected:

- **MTHFR**. A persistently high level of homocysteine, a frequently measured blood marker, could indicate an MTHFR deficiency. See "Do You Have MTHFR Deficiency?" in chapter 8 for details.
- **H. pylori** is a stomach bacteria and a nasty one. It causes stomach cancer, ulcers, and other serious problems. It is fairly common in the west, but endemic in much of the developing world. It should be treated with antibiotics. It is a tough bacteria, and several courses of antibiotics could be needed. Normal practice is to treat it when a symptom develops. It's better to be preemptive. H. pylori should be tested once, and retested again after any trips to countries having a strong prevalence. Re-test for this if living in Asia, visiting, or experiencing chronic stomach distress.

We are about to dive into the tests that should be done on a periodic basis. There is one test that should be done annually, and a couple of tests to be done bi-annually, and then a panel of quarterly tests. It is these quarterly numbers that run the show.

Tests Done Annually

Thyroid. Test Thyroid Stimulating Hormone annually. The test is called TSH and could indicate thyroid problems if too high. In such cases, energy levels will be low, and exercise will have less benefit. The standard "too high" level is 4 uiu/ml (or miu/L), but the warning bells should chime at anything above 2.5. For men, a doctor should be seen if this is the case and total testosterone is below 350/dl. For women, T3 and T4 should measured, and a doctor seen if they are low. We cannot give a precise number here, because different labs use different tests for this one. So here "low" should be taken to mean low according to the lab report. The cure for a weak thyroid is levothyroxine, a very inexpensive prescription medicine.

Test Tumor Markers Twice a Year

There are many tests available that could indicate cancer, and indicate it at a stage early enough for effective treatment. These are PSA, for the prostate, and

CA-125 for ovarian cancer. If CA-125 is above 20 u/ml, see your gynecologist. For PSA, trend is important, meaning more than one measurement is needed. If PSA rises more than 0.6 ng/ml in a 12 month period or less, see a urologist. If PSA is over 3, a urologist should also be consulted.

By the time you read this book, these tumor markers may be out of date. There is an enormous amount of work going on in this area. A fair amount of it is trying to come up with a machine that can match a dog's cancer sniffing ability. (Some trained dogs can reliably detect several cancers better than any machine and with an astonishing degree of accuracy.) In just a few years, it may be possible to detect most cancers at early, curable stages. Be sure to keep an eye out for these. Caught early, most cancers are curable, but caught late can be an entirely different story.

The All Important Quarterly Tests

There are about a dozen or so key blood markers that strongly determine your health, and if not in the ideal range, strongly indicate which areas need to be changed. All these markers should, ideally, be measured quarterly. This is not that expensive, probably under $250, and certainly worth the money. The sicker you are, the more insurance will pay, but it's hard to get a dime out of them for prevention, but prevention is the cornerstone of Quantitative Medicine. There is detail on how to get these tests, how to figure out which ones insurance will pay for, how to avoid overcharging, and how the insurance companies dictate medical care in the "GETTING THE TESTS AT A REASONABLE PRICE" section, later in this chapter.

Sixteen or so tests is a lot to become expert on, so we have sorted them into five groups that specifically relate to degenerative diseases.

- Sugar/Starch Management Group—how well you can metabolize sugar?
- Lipid Management Group—HDL and triglycerides.
- Stress Management Group—is external or internal stress affecting your health?

- Anabolic Management Group—is your exercise level getting you into a healthy anabolic state?
- Organs, Iron, and Bones.

Each group has two or three measurement numbers in it, which often tend to move in concert.

If you "fix" all these numbers, your risk of degenerative disease will decline. If you *really* fix them, substitute "plummet" for "decline." Here is an example where one size really does fit all. The various diseases may look different, but their root causes are all the same.

However, beware: "fixing" the numbers with supplements, as opposed to lifestyle changes, WILL NOT WORK, and usually backfires. Niacin is a perfect example. It raises HDL, the "good" cholesterol, but shortens lives, not the direction we want to head. However, HDL when raised by lifestyle change, increases longevity, and reduces both heart disease and cancer.

Many people are taking all sorts of supplements, and there are innumerable books on the topic. Over-the-counter supplements are basically drugs, and ought to be viewed that way. We would suggest you stop taking them all if embarking on the Quantitative Medicine program. Other than vitamin D, and in some cases B-12, we know of no case where supplements are beneficial, and frequently, they are harmful.

Your numbers may not need fixing. They may all be OK. You would then already be at low risk and could count yourself very lucky indeed, or maybe you have been taking very good care of yourself or maybe you are a hunter-gatherer. Otherwise, with just reasonable luck, you may have a single main issue. It could be sugar or stress management or something else. When you focus on this issue, you are performing this experiment: Will making this lifestyle change fix that number? Suppose you succeed. You have "proved" the lifestyle change did what you hypothesized. Doesn't mean it will work for anybody else, but that doesn't matter. The experiment you are performing is all about you.

Results vary. People vary. To our knowledge, no one has ever gotten worse using the Quantitative Medicine methodologies contained in this

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- NNH - Number Needed to Harm. How often do the side effects harm someone?

Thyroxin, testosterone, and vitamin D, used as we suggest, all decrease or have no effect on mortality, none cause any known harm.

Here is some information on some of the most widely used pills and supplements:

- Medications for mild hypertension (blood pressure<140): No one benefited, 1 in 12 were harmed.
- Statins for people with no known heart disease: No effect on mortality. Heart attack prevented in 1 in 60. Caused diabetes 1 in 50, caused muscle damage 1 in 10.
- The only vitamin supplement that doesn't appear to do any harm is vitamin D. A large study of older women (Iowa Women's Health Study) found the following alarming result: Daily multi-vitamin increased mortality 2.4%
- Vitamin B_6, folic acid, magnesium, and zinc increased mortality 3-6%
- Calcium supplementation also increased mortality 3% in one study at least.

Key Points

7 - STEP I - Testing

- We recommend you start with our standard lists.
- There are many measurements. We group them into sugar management, lipid management, stress management, anabolism, and other.
- Measurements that are out of the "normal" range should be addressed by your doctor. Most cases are no cause for concern.
- You will probably have to pay for some of your tests.
- There are many ways to avoid the overpricing endemic to the blood draw industry.
- A scan is recommended, but wait till you have access to a newer scan machine.

8 - STEP II - QUANTIFY YOURSELF

We'll suppose now that you got the tests mentioned in STEP I - TESTING or have decided to analyze some numbers obtained in the past. This section will show you how to interpret them. You may want to do this with your doctor.

Before we dive in, a couple of items need to be mentioned. First, the blood tests usually come back with "normal" ranges indicated on the test report. These ranges represent what the test labs usually see, and not necessarily some OK value. Second, different labs use different methods, and numbers can vary somewhat.

THE BIG HOMEOSTATIC-ANABOLIC PICTURE

In PART I, we hypothesized a gadget that would tell us how we were doing anabolically and homeostatically. We promised that this could be done with measurement. Here is how.

Your Anabolic Score

Score 2 points if your IGF-1 is in the range 130 to 170 ng/ml (higher is dangerous) or else score 1 if in the range 100 to 130. If your total testosterone in ng/dl is greater than 500 (men) or 20 (women), score a point. If your HDL is greater than 65 mg/dl for males, or 75 mg/dl for females, score 2 points, and score 1 point if HDL is below that, but above 55 mg/dl for males or 65 mg/dl for females. A total of 3 is good. 4 is superb, and 5 is Olympic material. These are exercise numbers. If you want to improve

them, consider increasing the intensity of your exercise rather than the duration. Keeping the score high will promote cellular health, retard aging, and stave off degenerative disease.

Your Homeostatic Alignment Score

We have repeatedly spoken of ideal homeostasis or alignment. Here are the markers that matter the most, along with their ideal ranges:

- Fasting insulin between 3 and 6 µu/dl
- A1C less than 5%
- Triglycerides below 100 mg/dl
- HDL greater than 65 mg/dl (male) or 75 (female)
- Cortisol below 12 µg/dl

Score 1 for each one of these you meet. The top score, 5, is great, and 4 is good too. A score of 0, 1, or 2 indicates a need for improvement.

Add your two scores together. You could be a perfect 10—perfectly aligned and anabolic. For most people this is achievable, though it would take some dedication and discipline. The reward for doing so is a long disease-free life. Most sensible and active 25-year-olds and most hunter-gatherers of any age would score a 9 or a 10. Any combined score below 5 should sound an alarm. Above 6 is pretty good. An average 55-year-old American would probably come in between 4 and 6. Someone with adult onset diabetes would likely score below 3.

Suppose the homeostatic score is good, but the anabolic score is not, or vice versa. What would this mean? A good homeostatic score with a low anabolic score would be found in many thin people. An older person in this category might be considered frail. The good homeostatic numbers mean degenerative diseases are not developing, but the low anabolic numbers mean the resources needed to combat these diseases are limited. Basically the body is conserving. Energy levels will be low. Cell renewal is suppressed. Osteoporosis could be a significant problem.

High anabolism with low homeostatic alignment could describe the athlete who takes steroids, or any individual who exercises, but perhaps overindulges. Cancer would be the main risk for this group.

For most people, some of the numbers will be in the desired range, and one or two others will not. This indicates where the efforts need to be deployed. Below, the numbers are broken down into groups and may

be analyzed more deeply. It is important to know exactly where the risks lie. Some of us are naturally prone to heart disease, others to cancer, and others to adult onset diabetes. All of these can be effectively combated.

Before we plunge into all this, we want to add this caveat—no cheating is allowed. By this we mean that pills, drugs, and supplements that might improve these various numbers won't improve your health prospects. It simply doesn't work that way. Niacin is a good example. Niacin raises HDL—the famous "good" cholesterol—and lowers triglycerides as well. However, niacin doesn't reduce all-cause mortality. In fact, it increases it. This is certainly an unwelcome surprise. Exercise will also raise HDL, but exercise increases life span. The moral: it's not the numbers *per se* that are causing the improvements; what counted is what you had to do to get those numbers. Unlike niacin, exercise improves HDL, but also improves a variety of other things. Niacin is not a substitute for exercise even though they both improve HDL. So far, no magic pill.

THE SUGAR MANAGEMENT GROUP

SUMMARY	SUGAR MANAGEMENT GROUP
MEASURES	Ability of body to metabolize sugars and starches
SCORING	Special Case 1 - Insulin less than 3 µu/dl - See "Hypoglycemia" Special Case 2 - Insulin less than 3 µu/dl- See "Are You Too Thin?" "A" - Fasting glucose below 80 mg/dl, A1C below 5%, Insulin between 3 and 6 µu/dl "B" - Fasting glucose below 90 mg/dl, A1C below 5.5%, insulin below 12 µu/dl "C" - Anything else
RISKS	"A" - Healthy "B" - Slight insulin resistance - early warning for adult onset diabetes "C" - Insulin resistant - significant risk of adult onset diabetes.
REMEDIES	"A" - No changes needed "B" - Cut some sugar and starch "C" - Cut all sugar and starch, or as much as you can tolerate.
TIMING	Results should be apparent in 3 months, retest at that time.

All About Sugar and Starch

Glucose seems to be a major player in most degenerative disease: The plaque that gums up arteries, causing atherosclerosis, typically has some glucose components in it. Excess sugar raises triglycerides, a major heart disease

risk factor. Excess glucose leads directly to insulin resistance, weight gain, and if carried far enough, adult onset diabetes. The brain damage seen in Alzheimer's tends to have glucose products present. Finally, glucose is a cancer promoter. Cancer cells usually can only survive on glucose, and they need a lot of it.

Sugar usually consists of a 50–50 mix of glucose and fructose. This is true for table sugar and high fructose corn syrup and roughly true for most fruit. Starches, however, are converted to 100% glucose. Both fructose and glucose go first to the liver, but after that, their fates diverge markedly.

Most of the glucose you consume passes through the liver and then directly into the bloodstream. The body then generates insulin, which acts as a delivery service, carrying the glucose through the bloodstream and delivering it to waiting cells. The muscle, brain, and other cells have first shot at this, but if there is glucose left over, it's stored as fat in the fat cells. So excess glucose makes you fat!

Fructose doesn't make it out of the liver in one piece. The liver first uses it to replenish its glycogen, a high-density form of sugar the liver builds and stores for later use. Once this is topped up, the liver converts the remaining fructose to triglycerides, the basic molecule of fat. It then packs lots of these little fat molecules along with cholesterol into VLDL particles and sends them off into the bloodstream. VLDL stands for Very Low Density Lipoprotein, and is a fluffy wad of triglycerides and cholesterol. As the VLDL particle floats by, cells can snatch a triglyceride and use it for energy. Muscle cells, fat cells, and in some cases brain cells do this. As the triglycerides are stripped off, the VLDL particle shrinks, eventually becoming LDL, the infamous "bad" cholesterol. So excess fructose increases your triglycerides and LDL cholesterol!

For these reasons, there is currently a lot of press suggesting that fructose is worse than glucose. Excess amounts of either are quite dangerous over the long run, and excess amounts of both are a prominent feature of the Western diet.

Fructose isn't really needed at all. The ever versatile liver can replenish its glycogen storage from glucose alone if need be. Glycogen is a massive molecule made up of perhaps as many as 30,000 little glucose molecules rather elegantly tacked together. It looks like a dandelion about to be blown. If the liver is building glycogen by using fructose, it converts it to glucose

before attachment. After a meal is digested and there is no blood glucose available from food, the liver will supply it by disassembling the glycogen-dandelion back into individual glucose molecules and letting them loose into the bloodstream. Quite versatile, the liver.

The muscles also store glycogen. (Actually, altogether the muscles store several times more than the liver.) They make the glycogen from the circulating blood glucose. The muscle glycogen is consumed first in exercise.

The amount of circulating glucose is tiny compared to the glycogen store: 5 grams circulating glucose versus 100 grams stored in the liver and 400 grams in the muscles. A fifth of an ounce of sugar in the blood, a pound of sugar in the muscles.

Young cells can metabolize glucose more efficiently than old cells. It is for this reason that children can get away with a sugar/starch intake that would rapidly get stored as fat in many adults. However, this obviously has its limits too, as we are reported to be in the midst of a childhood obesity epidemic. The obesity is the visible effect, but arterial plaque is developing, cellular stress is developing, along with insulin resistance, the hallmark of adult onset diabetes. If for some macabre reason you wanted to jump-start degenerative disease, excess sugar and starch in childhood would be very effective.

The Sugar/Starch Management Group Score

How is your sugar management? You get an "A" if fasting glucose is below 80 mg/dl, A1C is less than 5%, and insulin is between 3 and 6 μu/dl. Fasting means 12 to 14 hours after your last meal. Circulating sugar from that meal should be long gone and the hypothalamus should be regulating to your ideal reference point somewhere below 80. At this point, it's adding sugar to the blood by directing the liver to dump glucose from the glycogen that was stored earlier. There should be little need for the insulin escort, so its level should be below 6 μu/dl, effectively turned way down. A1C is an indirect measure of average sugar. The average includes the fasting levels as well as the higher levels that occur right after a meal. A score of 5% on A1C means an average level of 100 mg/dl. This in turn means either your body rapidly took up all the sugar and starch you ate, or you aren't eating much of it in the first place. If your A1C is less than 5.5%, fasting glucose less than 90 and the insulin less than 12, the score is a "B" for now, but if any of these

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WHAT CAN BE FIXED WITH QUANTITATIVE MEDICINE?

An important question you are no doubt asking is: "What's in it for me?" If I do all the changes you suggest, and fix my numbers, is that really going to modify my health? Will it really increase my longevity and prevent degenerative disease?

It definitely will. Individual results will vary depending on four things:

- Your personal genetic luck
- How old you were when you started the program
- How much trouble you were in when you started
- Your degree of adherence

If you start young and thoroughly comply, that long disease-free life becomes almost a sure thing.

Read the "Cohort" sidebars. Some of these people were quite sick. The vast majority of these people extricated themselves from various danger zones quite quickly and are on their way to permanent long-lasting health. We have little data on compliance, but suspect most of those who made less progress were not following the various protocols. It is not always easy to do so.

To be more specific, for the compliant, about 90% of the time, the suggested lifestyle modifications will change the numbers, and that will change the disease risk. There will be some stubborn cases and other lines of attack will be necessary, but for most, disease risk will be greatly reduced and disease-free life extended. Most people *will* experience these benefits:

- Elevated HDL and reduced cortisol will significantly reduce the risk of cancer.
- Driving down glucose, insulin, and triglycerides, is, almost by definition, a cure for adult onset diabetes. Driving down these same three will also tend to prevent the emergence of any dementias.
- Elevated HDL and effective management of triglycerides, coupled with a proper exercise program, will slowly bring down plaque buildup and greatly reduce the risk of arterial disease. It will begin to reverse atherosclerosis.

- Doing resistance exercise that involves big bones will prevent and reverse osteoporosis. If there is already loss of stature, that may partially reverse that too.
- Mental acuity and memory will improve.
- Quality of sleep will improve.
- Sense of well-being will improve.
- You will look younger—possibly a lot younger.
- In a medical and biological sense, you will actually *be* younger.

And sadly, there are a couple of items that usually do not return to their former glory, although some have reported an effect:

- Hair will not return to its original color, nor start growing again where it once grew.
- Hearing loss will not improve.

We have arbitrarily divided lifestyle into eating, exercising, de-stressing, and sleep. We will describe the specific effects that changes in each of these typically have on the key numbers. There is a lot of personal variation here, so the topics are discussed in somewhat broad terms. The idea is to choose modifications that suit your style, convictions, and likely compliance. Then try them out, measure again, and if necessary, modify further. Changes that improve health and longevity should not be a form of self-torture.

BIOLOGICAL AGE—TURN BACK THE CLOCK

Anyone who has been to a 40th or 50th high school reunion has seen the spread. Some seem fit as a fiddle, while others are shaped like one. Some are energetic, happy, etc., while others are not doing well at all. This is always cause for reflection and chatter, and is usually put down to genetics, or some other rationale. However, for almost the entire "class" the rate of aging actually reflects how close they stayed to ideal homeostasis and anabolism in that last 40 or 50 years, and has little to do with genetics. If you were to get a blood sample for each of the reunion attendees, you could plot "biological" age quite accurately. (Would certainly make for a memorable reunion, though you wouldn't likely be invited back.)

Here is what you could do though to estimate a biological age. Using the blood result from you fellow attendees, obtain the grade "A", "B," or "C," for

each of the four categories: sugar management, lipid management, stress, and anabolism. Take the current age, and for each "A" subtract three years, and each "C" add three years. The result is the biological age.

Those that got straight "A's would have a biological age 12 years younger than their chronological age. The sure way to get those "A's is by using Quantitative Medicine. So here is a way to beat the clock, or at least slow it down.

Key Points

8 - STEP II - Quantify Yourself

- You can compute scores based on the various measurements.
- A homeostasis/anabolism score will indicate your overall health.
- A sugar management score of "A," "B," or "C," will indicate how well you are managing glucose and insulin.
- A lipid management score of "A," "B," or "C," will indicate how well you are managing triglycerides and cholesterol.
- A stress management score of "A," "B," or "C," will indicate how stressed you are, both internally and externally.
- An Anabolic score of "A," "B," or "C," will indicate the extent you are in renew and repair mode.
- Liver, kidneys, and iron are also key measurements.
- Knowing all your scores allows you to focus and direct your lifestyle choices.

9 - STEP III - LIFESTYLE CHANGE GUIDELINES - DIET

THE HEALTH EFFECTS OF DIET

Dietary changes will have their greatest effect on the sugar management group of numbers, less on the lipid group numbers, and less effect still on the anabolic numbers. As far as disease prevention impact, adult onset diabetes and Alzheimer's would be the most affected, followed fairly closely by heart disease and cancer.

We will shortly get specific, but generally, if you got an "A" in sugar management, and you have been eating sugar and starch, you can continue to safely do so, but keep them on a short leash. The ability to metabolize sugar and starch tends to decline with age. If your numbers are sort of OK, a "B," say, cut carbs. Target the sugar first. Cut the sodas, the cake, then bread. For fruit, go for berries. If you got a "C," cut all these out. You are heading toward diabetes and need to reverse course immediately.

Insulin and Weight Gain

Insulin has many functions. One of the more insidious is this: if insulin is above 6 μu/dl, the weight-gain "switch" is on. No matter what you do, your body is going to try to conserve and store the food—especially carbs—as fat. You can starve yourself, which is as unpleasant as it is unhealthy, but as soon as you stop, your body will quickly replace any fat you lost. The way to trigger weight loss is to make dietary changes that will force your fasting

insulin to a level between 3 and 6 μu/dl. This is fat-burning territory and is very healthy. If your insulin is higher, cut out starch, sugar, and fruit to drive it lower. Between 3 and 6, you will soon arrive at your healthiest weight. If you exercise, this weight will be lower still.

Six Meals a Day

Actually, three meals and three snacks. Each meal should have a protein portion from meat, dairy, or eggs, and two or three portions of vegetables. For each meal, the size of each portion should match the size of your palm, or a bit smaller. Vary the meat, sometimes red meat, sometimes white, sometimes fowl, sometimes fish. Take quality (grass-fed for instance) over quantity. Don't worry about "lean." You need fat, including saturated fat, and likewise, don't hesitate to butter those vegetables. And don't worry about cholesterol. Your body will manufacture what you don't obtain from eating, so there is no point in avoiding it. Eat the colored vegetables like broccoli, spinach, kale, peppers, tomatoes, onions, green beans, cauliflower, whatever you like. Bake it topped with cheese, or stir-fry it with tasty spices. Once again, quality over quantity. Organic if possible. (Beware: Not all organic food is created equal. Some is more organic than others. More information is available below in the FOOD SOURCING section.)

Take a snack between each main meal. It should consist of between two and four ounces of similar sorts of foods. Perhaps a cheese snack, or some nuts. Perhaps leftovers, or carrots or celery with a tasty (non-soy) dip. Or peanut butter This sort of thing, but no chips. If you eat bars, avoid the sugar-loaded ones. Better still, avoid the bars. Their ingredients tend to be the cheapest the manufacturer can buy and still come up with a plausible label. The third snack should be taken at bedtime and should be tiny. Again, don't worry about fat.

Now then, what about fruit, bread, potatoes, cake, pasta, sodas, and all that yummy stuff? This is the part of your diet that can get you into

trouble, so here is where you need to focus your attention. The maximum amount will vary from person to person. For some, the maximum amount is *zero*. Others might be able to deal with quite a bit. However, you can determine a safe amount from blood tests. Of course you can make it easier by eating only real food: food that doesn't come in a package or can, and doesn't have a label. But if you are to avoid sugar, don't eat fruit.

We are about to show you how to determine a "personal sugar rule," which will give you useful dietary guidelines for dealing with sugar, fruit, and starch. There are four possible rules:

- Eat More Fruit and Starch.
- Hold the Line.
- Reduce Fruit, Sugar, and Starch.
- Fruit, Sugar, and Starch Are Forbidden.

But first, we need to deal with a special case: are you hypoglycemic?

Hypoglycemia

Hypoglycemia is an insulin management problem, and there could be many causes. If your fasting insulin is below 3 μu/dl and you aren't especially thin, hypoglycemia should be considered. In hypoglycemia, the hypothalamus seems to have an itchy trigger finger on the insulin gun. As soon as there is just a bit of extra glucose, it blasts some insulin with both barrels. This clears the glucose just fine, but overdoes it and doesn't leave enough in the blood, thereby creating a lack an hour or so later. That lack translates to a craving, which, if satisfied, restarts the cycle, and if not, leaves the person in a low-energy state. This pattern can be especially hard to escape.

There is a specific standard test for hypoglycemia. If your fasting insulin is very low, say below 3, or the above symptoms fit, you may well be hypoglycemic.

Hypoglycemia can be genetic, caused by bad diet, or due to other causes. However, it is easily managed. Eating six small meals a day of good nutrient-rich, low-sugar and lowstarch food will cure or at least manage hypoglycemia regardless of the cause. In fact, if you follow our dietary advice, there is little point to the test. The diet will cure hypoglycemia whether you have it or not. But bear in mind that you must eat the six meals (three meals + three snacks). Otherwise your glucose will sag between meals and you will crave sugar and be miserable.

[. . .]

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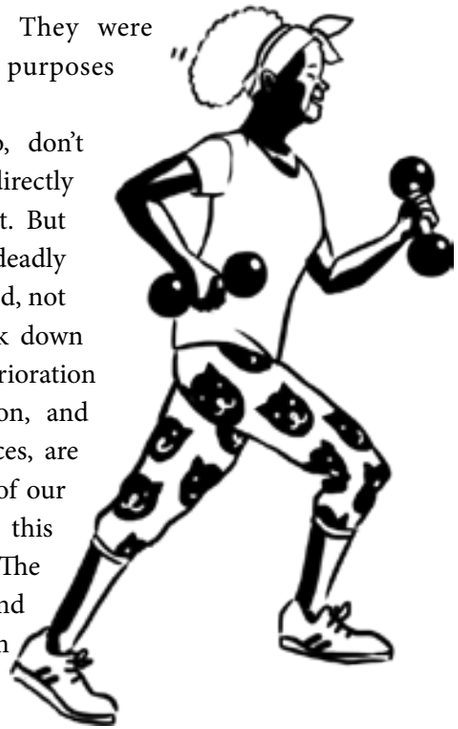
BIOLOGICAL POWER

We haven't talked much about cells and mitochondria. They are major topics in PART III. Degenerative disease prevention, mental health, energy level, slow aging—in short, everything—depend on the cells' biological power, their resources, and molecular machinery. Food is fuel; we want clean fuel. Stress and poor sleep compromise the cells; these problems must be avoided to the furthest extent possible. But exercise is what makes the cells active, makes them powerful and healthy.

This includes all the cells, not just muscle, but joints, ligaments, and tendons. Neurons (nerves) likewise improve their function. Even cells seemingly having little bearing on exercise, like those in the kidneys or liver (as noted by Dr. Buchan), benefit as well. As with most things in Quantitative Medicine, overall cellular health can be measured and optimized.

Mitochondria are tiny energy generators within the cells. In each cell, there are usually hundreds of them, sometimes thousands. They aren't really us at all. They have their own DNA and were once free bacteria. They were enslaved for energy generation purposes perhaps a billion years ago.



They generally do their job, don't rebel, and produce our energy directly from the fat and glucose we eat. But they extract a paradoxical and deadly sort of revenge: if they are not used, not worked, left idle, they will break down and poison the host cell. This deterioration of the cellular power production, and the subsequent toxic consequences, are one of the main causes of most of our modern health problems. But this deterioration needn't happen. The mitochondria can be kept busy and engaged, which in turn keeps them running smoothly and keeps them out of trouble.

EXERCISE AND YOUR NUMBERS

There are a range of exercises here, from easy ones that preserve and repair your joints to challenging ones that will preserve and repair just about everything else.

Physical activity has its greatest effect on your anabolic and lipid numbers, and a lesser effect on the sugar numbers. As far as disease prevention, heart disease, osteoarthritis, and osteoporosis benefit the most, followed fairly closely by cancer, adult onset diabetes, and Alzheimer's.

Exercise has innumerable benefits. A major one is its ability to increase HDL and especially the "mature" HDL—the "really good" cholesterol. Elevating HDL sharply reduces cancer and heart attack risk. Likewise, IGF-1 and testosterone, two major anabolic hormones, are also increased with exercise. These two (along with several others) greatly promote cell renewal and repair, and retard aging.

EXERCISE PROGRAMS

Most exercise programs emphasize weight loss, with the rest being mainly about bodybuilding. Our exercise program is like no other. You could say it emphasizes biological power—at least that is the end result—but it proceeds step by step, starting at the most fundamental level.

Our program is graduated from easy to strenuous, and its benefits track this progression. The more strenuous levels provide greater health benefit and disease prevention. You may or may not be a regular exerciser, but read through them all. Make sure you understand the concepts behind joint health maintenance and osteoporosis prevention, and are tailoring your exercises to encompass these. As you progress, attention will be focused on heart rate and its response to exercise. This is key to cardiovascular health. Finally, keeping the mitochondria busy and challenged provides the huge energy increases, degenerative disease prevention, and increased mental acuity that are the hallmarks of Quantitative Medicine.

This may sound a little complicated, but ahead is a step-by-step approach. Follow it carefully, and you will succeed. To summarize, here are the key points in the order in which they must be mastered:

Skeletal Health

The initial exercises aim at getting the joints into good shape, with full range of motion, strengthening the tendons and ligaments, strengthening the bones, and stimulating the neural-muscular paths. If you master these:

- You will completely repair and strengthen your joints, preventing or reversing osteoarthritis.
- You will improve your coordination and balance, causing new nerves to grow. (You may have once been taught that you cannot grow new neurons or nerves. This is incorrect.)
- You will strengthen your bones, preventing or reversing osteoporosis.

These items alone can benefit a good many people, and can be accomplished with a fairly easy program.

Heart Rate Variability

Many doctors recommend brisk walks and other modest approaches to exercise. While better than nothing, the heart and vascular system aren't particularly challenged. The heart will get into a groove. It will become efficient at dealing with the modest demand placed on it, but will be unable to accommodate increased workloads.

The modest elevation in heart rate means a modest increase in blood pressure and blood flow, but the cleansing and rejuvenating effects of a brief high pressure and high blood flow rate will not occur.

Running the heart rate up and down, intensely, but briefly, circumvents these problems. (And takes far less time as well.) Such activities strongly stimulate arterial repair and general heart-lung capacity. Heart attack instances plummet with such exercise, and, somewhat amazingly, cancer plummets as well. "Intense" sounds like work, and it is. However, the time is considerably shorter. A 30-minute brisk walk, for instance, might be replaced with three 30-second sprints up a hill.

The health benefits of this sort of exercise are hard to overstate. Repeated research has shown again and again that short but intense exercise practices are markedly more beneficial, with noticeable health improvements occurring within weeks.

Mitochondrial Health

In a state of ideal peak health, the energy-generating mitochondria are busy. Their efficiency goes up, as does their rate of proliferation. Such a state pushes every cell in the body toward its individual peak performance. This translates to better mental acuity and memory, slower aging, and a healthy and active immune system that completely overwhelms degenerative disease.

Attaining this level of health entails yet more dedication, but is available to all who are willing to make the commitment. Exercise sessions become more strenuous, but not necessarily longer. For most people, two intense 45-minute sessions per week, with a third milder one added for maintenance of balance, coordination, stability, and flexibilityO will do it.

THREE CAVEATS

Though it works faster than most exercise programs, ours is not a quick fix, but is instead a lifetime commitment. The system works, has been endlessly refined over the last 20 years, and for most, will deliver the promised results. Consider wisely what level of commitment you are willing to make. Be careful and be patient. Take note of these three caveats:

Avoid Medical Risk

Consult a physician before undertaking any of this. Tell him or her what you are intending to do and see if there are limitations you should observe. You may need to get some tests to determine this. Try to avoid having the doctor dictate the type of exercise. This isn't likely to be productive. (For decades, most doctors have recommended aerobic exercise. This is a poor form of exercise, and time consuming as well.)

Don't Overdo It

Joints and tendons take a few months to strengthen, but can take a couple of years to heal if you injure them. You will be building muscle strength faster than joint and tendon strength, so you will be in a position to injure yourself. Start slowly and build up. If you ignore this warning (and most people do) you will likely get injured, which will significantly slow your progress. Some soreness is normal. Some joint pain is normal. So you have to push yourself a bit, just don't overdo it. Pain should subside after two days at most.

[. . .]

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food was plentiful, but we are largely free from any such constraints. Hunter-gatherers would sleep a lot more in the winter as well.

Maybe we do adjust our sleep seasonally. Maybe we are still tuned in to those ancient voices. It would be hard to hunt and gather on a stormy day. Is this why it is so easy to stay in bed when you hear that rain outside?

Key Points

9-10-11 - STEP III - Lifestyle Guidelines

- Lifestyle changes can make a great difference in your health, far greater than any currently available drugs.
- Most degenerative disease is preventable. Some is reversible.

EATING . . .

- Eating modification has the most effect on sugar numbers.
- Eat three meals and three snacks per day.
- People can tolerate varying amounts of sugar and starch. This has to be determined from blood tests. Establish your Personal Sugar Rule.
- Eat one portion of protein, two or three of vegetables.
- Energy bars may be used for snacks if chosen to have the correct ingredients.
- Check that you are not insulin resistant, not hypoglycemic, and not too thin.
- Do not worry about dietary cholesterol and saturated fat.
- It is difficult to thrive on a vegetarian diet, even one containing eggs and dairy.
- It is very difficult to thrive on a vegan diet.
- Fasting is usually not beneficial.
- Calorie restriction does not appear to work.

EXERCISE. . .

- Exercise will primarily affect anabolism numbers.
- Intensity is far more important than duration.
- Do joint exercises to prevent osteoarthritis.
- Do balance and coordination exercises.
- Do squats and deadlifts to prevent osteoporosis.
- Do anaerobic threshold exercise (interval rowing, etc.) to increase heart rate variability.
- Do explosive resistance exercise (squats, deadlifts, etc.) to increase anabolism.

STRESS. . .

- Try to minimize day-to-day stress.
- Practice 10 minutes of meditation per day.

SLEEP. . .

- Get at least 7½ hour of sleep.
- Quality is important.
- Lack of sleep has serious health consequences.

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12 - WAITING FOR THE RESULTS

Quantitative Medicine is an iterative process. Quantify yourself. Get measurements, and compare them to the known desirable numbers. Then select a direction to head, a lifestyle change to undertake. Make it and reassess. This is a lifetime process. Even though you drove your numbers to ideal levels, they will change as you age. You will have to keep measuring and modifying to stay in your health "groove."

How fast will the body react to lifestyle changes? For some areas, almost immediately; others could take months or longer. As usual, there will be considerable variation from person to person, but here are some estimates.

Sugar management issues that are short of full diabetes will respond in as little as three months. Triglycerides, insulin, and fasting glucose should move significantly toward an ideal homeostasis in this time. We would suggest you decide on a very specific program, hold rigorously to it for three months, then retest for just the sugar management numbers.

As an example, suppose your fasting glucose was 100 mg/dl and your triglycerides were 140 mg/dl. These are not all that bad, but they are not ideal either, and may be indicative of an undesirable trend that needs reversing. Further suppose you cut out all starch and all sweets for three months, while still eating fruits. So a diet of meat, vegetables, and fruit, but no bread, pasta, cake, cookies, etc. At three months you retest the sugar management numbers. Your numbers should be noticeably different. Fasting glucose should be below 90, triglycerides should be below 100. They may be better than this or worse. However, you will now have "quantified" yourself. You know how much the numbers shifted in response to your lifestyle change.

Possibly you did really well and got a fasting glucose of 75 mg/dl and triglyceride level of 90 mg/dl. Congratulations. On the other hand, if you did not get below 80 for glucose and 100 for triglycerides, you didn't cut enough, and the fruit will probably have to go, along with alcohol. Or perhaps you could still eat berries and cut something else—berries are metabolized relatively slowly. You get the idea. By experimenting, you can push the numbers toward, and eventually into, the ideal ranges. Since this needs to be a lifelong change, take it easy and give things time to adjust.

The lipid group works somewhat differently. Triglycerides, as we just saw, move rather quickly. The HDL and LDL numbers depend on both diet and exercise, and take longer to change, perhaps six months, but possibly as little as three.

The anabolic group is mainly responsive to exercise and should show a lot of improvement by within six months.

The stress group of numbers responds very quickly. Success in stress reduction will show up rapidly, at least at the subjective level. Stable and lower cortisol could take many months to reach.

Adult onset diabetes involves an entire syndrome of problems and it might take as long as a year for things to reach an ideal homeostasis. However, there will be immediate and measurable progress.

There are many overlapping processes at work in a change of lifestyle. Using this book as a guide, each individual will have to take an educated first guess at which lifestyle changes will be needed to drive the various key numbers to ideal homeostasis.

LIFESTYLE CHANGES AND EXISTING DISEASE

We have mentioned degenerative disease throughout, but mostly in a preventive context. This is not a book about treatment. If you know you have a degenerative disease, or the testing indicates you might, you should be under the care of a practitioner. That said, it is important to know the effects that lifestyle changes have on these various diseases, and whether or not the change is likely to have much effect on existing disease, or whether it is primarily for prevention.

Achieving ideal homeostasis and anabolism will block all degenerative diseases. The effect on preexisting degenerative disease varies:

- Adult onset diabetes will be reversed and cured.
- Alzheimer's will be slowed, and in the early stages even partially reversed.
- Atherosclerosis will be halted, and slowly reversed.
- Cancer in principle will be slowed, but if a tumor has resulted, it must be treated. Future cancer risk and risk of recurrence of a treated cancer will both be reduced.
- Osteoporosis can be stopped and reversed. Loss of stature will, in some cases, reverse also.
- Osteoarthritis can be reversed in some cases.
- Aging will noticeably slow.

Everyone has different propensities to various diseases. However, the root causes of these diseases are all the same, and if the ideal homeostatic set-points are attained, along with a stable anabolic state, the progression of these diseases is greatly reduced, if not reversed.

The methods needed to attain these ideal states vary considerably from person to person. Everyone needs to find their own ideal health formula.

However, the protective effects of ideal homeostasis and anabolism are common to everyone. And equally, everyone can effectively pursue these goals. Discipline and perseverance are necessary, but this is true for most worthwhile things, and most people have familiarity with such undertakings. Achieving these health goals should lead to a long and healthy life.

IF THINGS DON'T PROGRESS AS EXPECTED

The measure and modify Quantitative Medicine approach works well for 80 to 90% of the population. However, sometimes it is slow, and sometimes it doesn't work at all. Here some common problems:

Difficulty with Carb Reduction

Ease of adjustment to carb reduction varies from person to person. Cells can run on glucose, fat, or even protein. However, the actual mechanisms to convert those nutrients to energy are quite different, and cells tend to adapt and lock-in to the ones they are accustomed to seeing. When the nutrient base changes, the cellular processing machinery must change as well. This WILL happen, but not instantly. We have no cases where

people were completely unable to process fat. Rather, it's a question of time. For some, it is almost immediate, but for others, it can be quite difficult. If the cellular adjustment is slow, you will feel low-energy and malnourished during the transition. The fastest way is to just tough it out. However, you can make a slow transition as well if you prefer.

TESTIMONIAL

My Personal Experience with the Quantitative Medicine Nutritional Advice

My friends Charlie and Lien seemed to belong to some strange cult and were insistent that weight gain was carb-driven. They said crazy things such as, "Eat as much fat as you want, but don't touch a carb."

I had never been overweight, but once I got into my 40s, my weight started to creep up. I tried various diets and swam regularly, but this did not help. Taking the advice of Charlie and Lien, I decided to cut carbs completely to see if I could get results. Unfortunately, the results were not good! I felt simply awful—always hungry, tired, and weak, particularly after exerting myself. My conclusion was that I was a person that simply had to have carbs.

I consulted with Charlie and Lien, who asked their doctor for advice on my behalf, and was told that the transition to a no-carb diet could take up to six weeks. As it had already been four weeks, I decided to tough it out for two more. However, after six weeks, I was still craving carbs and feeling awful. The doctor's response was to hang tough, it will happen. Grumpy and hungry, I decided to persist. I managed to make it to the eight-week mark, and although I still felt hungry most of the time, I had lost some weight. This gave me enough of a reward to continue.

Finally, after several months, my cells had figured it out! My cravings for sugar and starchy foods like bread and pasta are now a thing of the past. I am no longer hungry all the time. My weight has stabilized at a point that satisfies me and, best of all, I finally feel terrific—full of energy and happy to be slimmer. I no longer like the taste of excess sugar and find that a little goes a long way.

- Kate Goddard

Glucose Declines, but Not Enough

Here, fasting glucose drops, but sticks at a high number. For most people glucose will drop below 90 mg/dl. This includes adult onset diabetics. (If you were diabetic, and got to that level, or even below 110, consider yourself cured.) For people with quite high glucose who cut out starch and sugar, the number will fall quite rapidly. Somewhere between 90 and 120, the fall might slow down or stop altogether. The first line of attack in this case should be to cut the carbs further. You can safely cut them down to zero if you want, but more practically, shoot for below 50 grams per day. Also, it may take a few months. However, after six months, if your fasting glucose is still above 90, take a look at your A1C, which is an indication of your overall glucose. If it is 5.2 or less, you have probably done all you can. A fasting glucose of 110 and an A1C of 5.2 are not all

that bad. If you maintain it, your risk of degenerative disease will be fairly low, but don't let up. And, as a rule, with A1C in the ideal range, the fasting glucose will eventually fall as well.

Less Weight Loss Than Desired

There was some initial weight loss, but not as much as desired. Fat, like so much else, is regulated by the hypothalamus. The hypothalamus will burn it until you reach its idea of your ideal weight. Its idea may not jive with your own, but it is trying to put you at the optimum weight for health purposes. Recall that the healthiest weight range is normal through overweight, and that if your insulin is not too high, your body will regulate your weight to its healthiest value. It may not be in your best interest to make heroic attempts to lose more weight.

Cutting or Quitting Alcohol Causes Carb Craving

Such a craving can result in surreptitious compensatory overeating. Possibly some things are being eaten that weren't in the past. Chips,pretzels?

Exercise Aches and Pains

In perhaps a majority of cases, the advice to go slowly and strengthen ligaments and tendons is ignored at first. However, it is a lesson quickly learned. If exercise is causing increased back and shoulder pain, the cause is usually excess enthusiasm, meaning failure to implement the training sequence.

Start over. First get all the joints working full range, and then gradually increase the load. If you tore or pulled some tendons or ligaments, go easy. They will take time to heal. You should work them lightly, and it's OK if they hurt a bit the next day, but that additional pain should be gone two days later.

Add weight slowly. Strengthen the ligaments, tendons, and bones first. Then the heart and lungs, and finally, the muscles. Muscle adapts easily, and insufficient attention to tendons and ligaments will result in injuries.

In a Nutshell

- Measure your 16 or so key numbers.
- See which ones should be improved.
- Figure out which lifestyle changes should improve them.
- Make the changes and measure again.

Some people are already in ideal ranges. Obviously as long as this persists, nothing needs to change. This comprises around 10% of the general population and around 90% of the hunter-gatherers. For many people, there will be a single problem group, perhaps sugar management, lipid management, or osteoporosis. This permits a focus, which, for most people, seems to speed up the change.

If many things are wrong, all of the lifestyle modifications may have to be rigorously followed. Adult onset diabetes tends to push everything out of ideal homeostasis, but the improvements will be equally broad and dramatic.

If discipline and perseverance are present, Quantitative Medicine seldom fails. It is a complete health management system.

Key Points

12 - Waiting for the Results

- Response to lifestyle change varies considerably.
- Sugar numbers should move significantly in three months.
- Lipid numbers take three to six months.
- Stress numbers can improve almost immediately.
- Adult onset diabetes can take up to a year.
- There are numerous special cases.

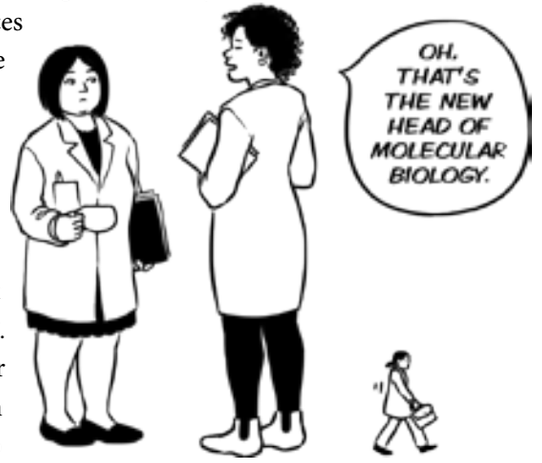
PART III - THE SCIENCE OF QUANTITATIVE MEDICINE

WHO ARE WE? HOW DID WE GET HERE? WHY AREN'T WE WELL?

13 - INNER SPACE

Quantitative Medicine's basic principle is simple enough in concept. Measure someone's health, i.e. quantify it. Then make necessary changes to correct those measurements—to move them to the ideal zones. Measure again to monitor the progress and check for any needed mid-course corrections. The measurements define your health. If they are optimum, your health will be too. If you improve them, your health improves. They are locked together.

What to measure and its interpretation were the topics of **PART-II**, but little justification for all those measurements and adjustments was given. We will undertake to remedy this now in PART III. We weren't deliberately withholding information in PART II. It was mainly an issue of complexity. We need to delve into the working of the body at the cellular level and address how all those pieces interrelate if we want to have a deeper understanding of why we get sick and specifically why we get degenerative disease and finally, how to counter it.



For those who want that explanation, here is PART III. Here we delve into molecular biology and our own evolutionary past and try to

see how it all came to be, why are we what we are, and why we respond the way we do. If you are only interested in measuring and making the changes that will arrest and reverse degenerative disease, PART II is all the information you will need.

For those wishing to move forward, we have a lot of underlying science to cover. It is tiny science indeed. We generate energy from sugar and fat by manipulating individual electrons and protons. It doesn't get much tinier than that.

To explore the body's mysterious and complicated workings, we could take the medical school approach and start enumerating all the parts, bones, muscles, and so on, but this is a fair amount of drudgery and doesn't really get us much closer to the all-important why?

In fact, to explain how Quantitative Medicine works, it is far better (not to mention more fun) to "evolve" a human from scratch. We will start with primordial soup and finish with a working human being, complete with brains, picking up the various parts as they become available.

The only problem with this approach is that rather than following a nice well-marked road, it will be more like crossing the murky waters of Lake Unknown.

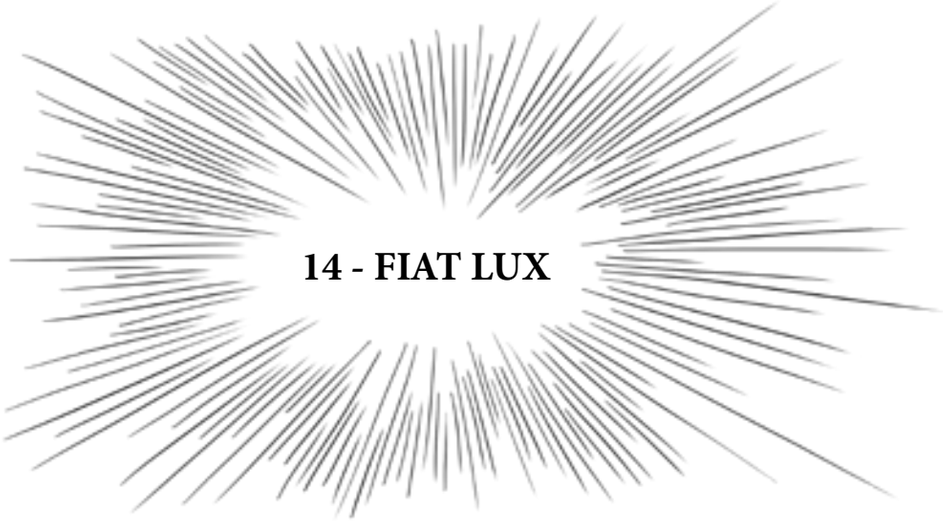
Lake Unknown is vast, and we will be hopping from stepping-stone to stepping-stone. Sometimes we will have to hop pretty far. There's just a lot that is not known: a lot of missing links, and places where evolution seems to have simply jumped way ahead. Still, it's what we've got.

So we will start from the very beginning. Once we get our human evolved, we can specifically examine why he gets sick, and see what actually transpires to cause good, healthy cells to go astray, for all degenerative disease starts and stops at the cellular level.

Finally, we explain why the cure works: how relieving cellular stress allows the well-evolved repair mechanisms to clean up and renew.

With our Quantitative Medicine toolkit, we will be able to precisely measure health, particularly cellular health.

So let's get ready for the first hop. It's a really big one…



14 - FIAT LUX

Let there be light. Thirteen billion years ago there was nothing, and then in an instant, an entire universe, or at least its beginnings. The Big Bang was a colossal blaze of pure energy. And nobody really knows how or why it happened. It just did. But "it" happened in such a way that there could be matter, atoms, elements, and the like. We take the existence of atoms for granted, but they too are mysterious. Why are electrons so much smaller than protons? Why are atoms attracted to each other? Why is there gravity? There are dozens of other such fundamentals about which we are entirely clueless.

The Big Bang itself produced huge clouds of hydrogen and little else. These clouds coalesced into the original stars. No planets yet. No elements either, aside from hydrogen and some helium. These two gases clumped together, developed enough internal pressure to ignite, and become stars of varying sizes. Stars of all sizes are still forming. Some others are dying, and a few have blown up.

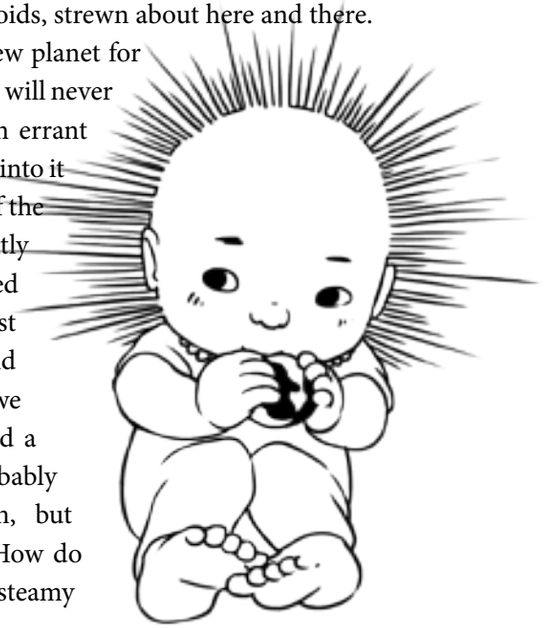
The larger the star, the shorter its life, with the largest of them lasting only a million or so years. Above a certain size, a star will finish its existence in a colossal explosion called a supernova. This grand finale has a marvelous side effect: it produces, via fusion, all of the heavier elements. Aside from hydrogen and helium, the material for the entire rest of the universe was manufactured this way. This includes our own personal collection as well as everything around us. This is still going on. Smaller stars, like our own, don't explode. They just slowly fuse into a couple of additional elements. The larger ones collapse into black holes. Our own star, the sun, is of fairly

modest size and isn't quite large enough to end up as a black hole. It will die, leaving a large lump of coal, its remaining atmosphere drifting away as a nebula-like cloud. We have about five billion years to worry about this. Good thing.

But we are getting ahead of ourselves a bit. Let's zoom in to around nine billion years after the Big Bang—four billion years ago. A lot of the initial fanfare has subsided, and thanks to the supernovae, we have all the heavier elements we are going to need. We wouldn't have evolved very far with hot gas alone, except perhaps as politicians. Our own corner of the universe had been fairly quiet for all those billions of years, but finally, just enough gas and rubble had accumulated for things to start to happen.

OUR LOCAL LUX

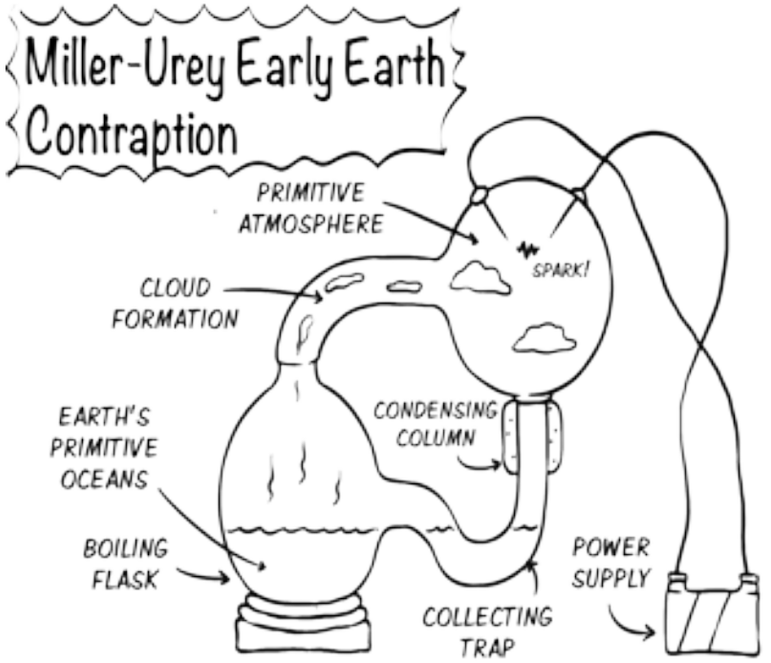
Five billion years ago, our solar system wasn't quite solar yet, still just a rotating disk of gases and debris from various supernovae. Gravity managed to gather enough hydrogen together in the center of this disk to ignite, and the sun was born. A new baby sun, less energy than now, but still plenty. Most of the remaining rubble and gases formed the planets; other bits and pieces became comets and asteroids, strewn about here and there.



Earth muddled along as a new planet for around 200 million years, but we will never know what went on because an errant planet the size of Mars slammed into it and basically blew it up. Some of the original Earth was permanently lost to space, some coalesced to form the moon, and the rest settled back to form what could be called Earth-II. And away we go. Days were shorter then, and a lot hotter. Was there water? Probably not much after that collision, but some was evidently acquired. How do we conjure up life on this hot, steamy barren rock?

We're going to cheat a bit and peek at the answer. We find that all life as we know it is built mainly from a couple of dozen amino acids. A good next step would be to acquire a supply of these. Amino acids are fairly simple molecules, primarily concocted from a small set of atoms, mostly the Big Four—oxygen, hydrogen, carbon, and nitrogen—but sometimes sprinkled with sulfur or selenium. Thanks to all the supernovae, these elements are plentiful. Time to put them together. But how? There's no living thing available yet to do the assembly.

Could there be a way to get the amino acids from natural processes? Researchers Stanley Miller and Harold Urey took a shot at this in the 1950s. They created a contraption that would plausibly simulate conditions on early Earth: a lot of heat, clouds, a watery soup loaded with the six necessary elements, and finally, a key ingredient—lightning. Success! They got the whole kit. Out of this hellish brew, all the amino acids needed for living things were formed.



That's progress, but it's one thing to have the construction materials, and quite another to put them together. On to the next step.

[. . .]

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We have even retained the anti-virus defense that bacteria managed to evolve: virus-destroying enzymes known as defensins.

Perhaps we should have a Bacteria Appreciation Day. Or perhaps not. They have also caused us a host of problems.

One major difference from the bacterial way of life is the sanctity of the DNA. Bacteria will swap DNA randomly, add bits, remove bits, constantly changing. Multi-celled creatures (and some more complex single-celled ones) sequester it in a cell nucleus, continually protecting, repairing, and preserving it.

We now have what we need from Bacteria World, so it's time to move on. We have quite a way to go, and a few more leaps across the stepping-stones of murky Lake Unknown, but the leaps are perhaps getting a bit more manageable. At this point, we know how DNA works, how body parts are built, how cells generate energy, and how they interact with their outside world. We are halfway there.

Key Points

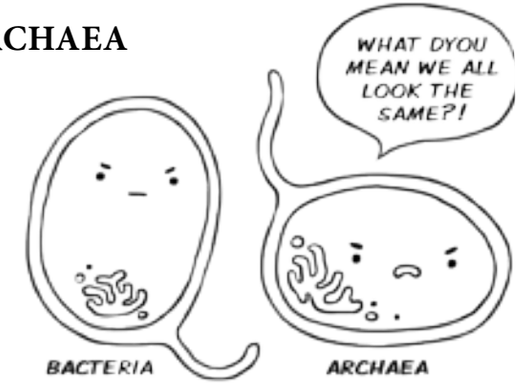
15 - Bacteria World

- Bacteria have DNA.
- DNA is redundant and therefore less susceptible to damage.
- Bacteria are everywhere, vastly outnumbering all other life forms, and equaling them in weight.
- Some bacteria can convert oxygen and other materials into energy with very high efficiency.
- The Krebs cycle was a bacterial invention.
- ATP is the universal energy molecule, used in all of life.

16 - THE GRAND MITOCHONDRIAL DEAL

Life is currently divided into three domains: Bacteria, Archaea, and Eukaryota. This is a relatively recent development. Bacteria and archaea were lumped together prior to around 2005.

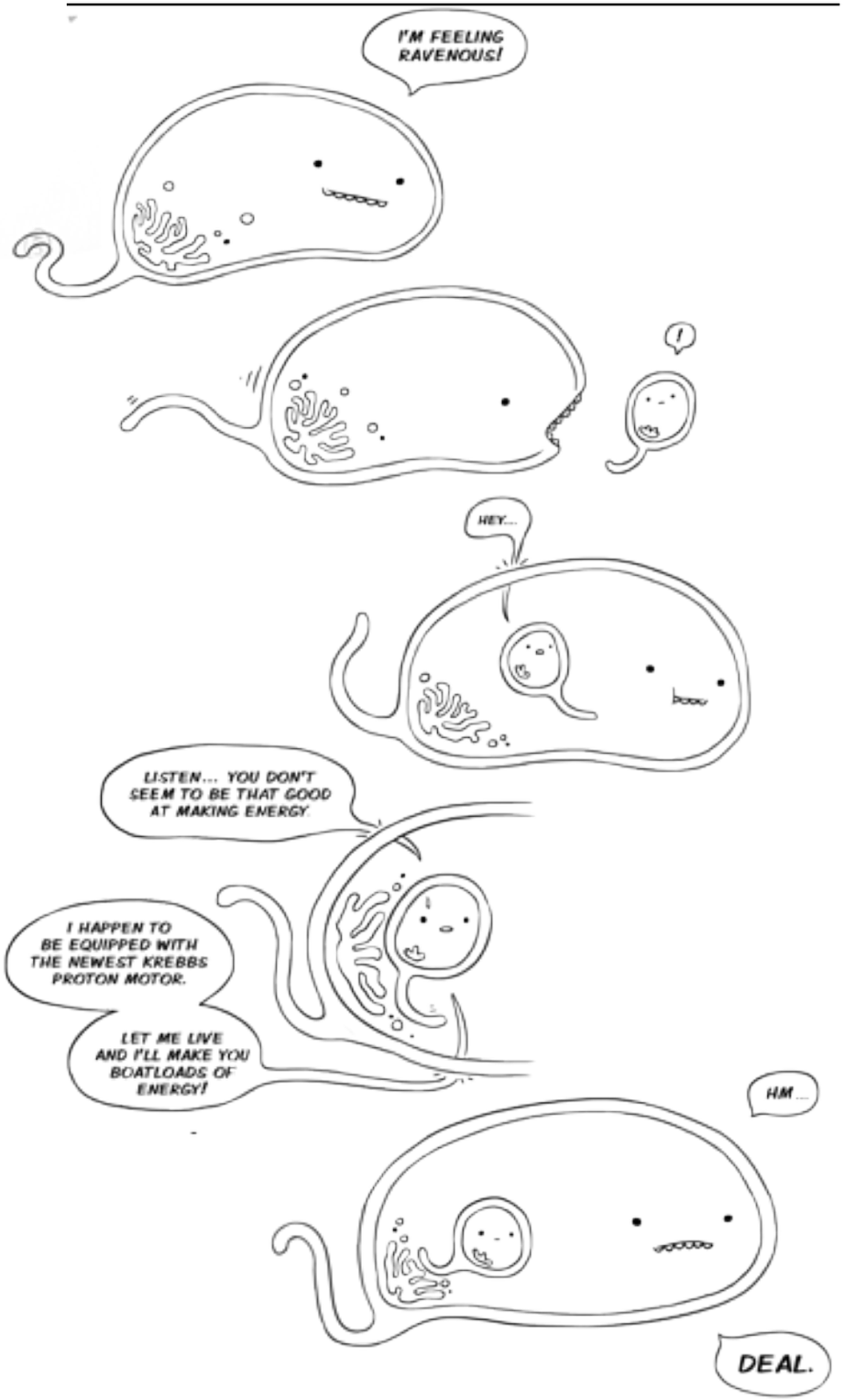
BACTERIA AND ARCHAEA



Bacteria and archaea look the same: microscopic single-celled creatures with circular DNA and so on. Apparently there is a significant genetic difference. Their ribosomes work somewhat differently, the cell membrane is different. This may not seem like a huge deal, but it apparently is to those who worry about such things. For us, it does have impact: we appear to be a hybrid of the two.

THE BIGGEST LUNCH DEAL EVER

Little decisions can have major consequences. Around a couple of billion years ago, an archaea, out for a leisurely swim, decided to take a lunch break, and something along the lines of the following transpired . . .



. . . they shook flagella on it, and thus was born the first eukaryote. The newly enslaved bacteria got renamed mitochondria.

The mitochondrial slaves made good on their side of the deal, dividing and dividing, and producing quite an excess of energy. The newly born eukaryote also divided, each time splitting the mitochondrial crew among the new progeny.

What a colossal deal. The eukaryotes grew and prospered, eventually becoming multi-cellular, with elaborate, multiple strands of DNA. The stalwart mitochondria remained true to their heritage, hanging on to their own separate DNA genome, duly maintaining it in its bacterial-like loop. It's still that way. All higher forms of life are "infested" with these mitochondria. They are not us, though we wouldn't get very far without them. Analysis of their genome suggests that all eukaryotes are descended from that one lunch deal. This includes us, plants, fungus, and the tiny world of one-celled protozoa. This could mean that it only happened once, and we are all descended from that single strange lunch bargain long ago. Or maybe not. Plants, in addition to mitochondria, also have chloroplasts, another enslaved bacteria.

However, the rarity of this symbiotic capture speaks volumes about the prospect of finding life elsewhere. This planet had been a bacterial (and archaeal) soup for 3.5 billion years, with uncountable encounters like that described above on a daily basis. Yet the "deal" only happened once. It must, therefore, be very unlikely indeed. So when we are finally visiting the faraway galaxies, we may well find an abundance of slime worlds, and little else.

But let's get back on track here. The lunch deal theory is but one of several, each with its strong and weak points, but however it came about, we now have a single-celled creature with other creatures inside, generating energy. With all this extra energy, what can be evolved? Even the simplest eukaryotes have these new features:

- Sex. Reproduction from parents is now possible.
- Nucleus. Eukaryote DNA is now protected in a nucleus. No more genetic hanky-panky, like those swinging bacteria.
- Other organelles. The excess energy supports other gadgetry within the cell: chloroplasts (plants), Golgi apparatus, and others.
- DNA is no longer a single, circular chromosome, but is pairs of DNA strands.

[. . .]

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But Pasteur was convinced that the various microbes did a lot more than souring the wine. A key discovery was made via fortuitous accident (not at all rare in science). Pasteur was studying chicken cholera and had inoculated a brood directly with the disease. However, though the chicks got sick, they all recovered. Pasteur then discovered the "problem." His stock of cholera was weak, lacking in virulence. Would this work? Could you produce a weakened version of a dreaded disease and achieve immunity? The answer was yes, of course, and Pasteur went on to conquer an impressive list of diseases, notably anthrax and rabies. Blissfully, there are no anecdotes about Pasteur experimenting on his servants' children.

The end was in sight. We now knew the cause, and we also had the potential technology to effect a cure. It remained to identify and conquer the rest of the lethal microbes and devise a means of distribution (still a major problem). One by one they would fall: typhoid - 1896, tetanus - 1897, diphtheria - 1905, whooping cough - 1925, yellow fever - 1937, polio - 1953, hepatitis B - 1980, but the battle never ends. Bacteria and viruses are famous for rapidly evolving, and new pathogens appear like AIDS and Ebola. Nonetheless, we are winning the battle. A century ago, a fever could be nothing, or it could mean a fatal disease, and for half the children of the era, it indeed did. This is clearly no longer the case.

With infectious disease, if not conquered, in full retreat, we should be in the golden age of health. In many ways we are. Life spans have doubled—even tripled—in the last 100 years. However, we didn't arrive where we might have. We aren't living disease-free and we are not living as long as we potentially could.

What went wrong? We have to take a deeper look into the cells to find out.

Key Points

19 - Hunter-Gatherers and the Agricultural Revolution

- Hunter-gatherers became the improbable apex predator.
- Hunter-gatherers seldom got degenerative disease.
- Average brain size 10,000 years ago was slightly larger than today.
- The agricultural revolution had huge negative health impact.
- Civilized health would slowly get better.
- Vaccines were discovered and most infectious disease was conquered.
- In the last 100 years, degenerative disease has replaced infectious disease as the leading cause of death.

20 - DEGENERATIVE DISEASE OVERVIEW

Most, if not all, degenerative disease is a direct result of chronic stress, either systemic or cellular or both. The causes of this stress are many, and it almost seems that modern society has conspired to make this so.

We divide lifestyle into four areas. Which choices are made in each contribute significantly to disease cause or cure. Here are the four, along with some of the problems typically associated with them.

Nutrition. Cells are not receiving the micronutrients they need, and at the same time are overloaded with glucose, insulin, and triglycerides.

Exercise. Lack of physical activity directly inhibits the powerful healing properties of HDL, and idle cells tend to load up with toxic trash, free radicals being the best known.

Stress Management. Stress elevates cortisol. High cortisol down-regulates the immune system, increases fat storage, and raises insulin. All of these are promoters of cellular damage. High cortisol undermines the benefits of proper diet and exercise.

Sleep. A lot of the body's extensive cellular repair apparatus works only at night, when energy is not needed for other activities. Poor-quality or interrupted sleep is very detrimental.

Likewise, we focus mainly on the resulting diseases:

Atherosclerosis. This condition, a buildup of plaque in the arteries, leads to heart attacks and strokes. The cause of this buildup is primarily dietary. A correct diet greatly diminishes the proportion of dangerous circulating lipid particles (the main cause of the problem), while the

correct exercise greatly elevates the amount and improves the intensity of the repairing mechanisms.

Adult Onset Diabetes. This syndrome, a state of high glucose, insulin, and triglycerides, is a perfect launchpad for all degenerative disease, and is mainly diet driven. It is readily reversed and cured with lifestyle change. Left uncured, multiple serious problems are all but inevitable.

Cancer. This is the unbridled proliferation of damaged cells. Cellular damage is common, but exacerbated by dietary elements, stress, and lack of exercise and sleep. The immune system is entirely capable of blocking cancer if not overloaded with poor lifestyle choices.

Osteoporosis. A sedentary lifestyle will slowly diminish bone strength. This is true for both men and women. Proper resistance exercise can halt osteoporosis and even reverse it.

Our lifestyle choices can also lead to rapid aging, dementia, and osteoarthritis, and these three are preventable as well.

QUANTITATIVE MEDICINE CURES DEGENERATIVE DISEASE

This is a vast statement, and if true, it is the health magic the world has been waiting for, wishing for. And it is completely true—demonstrably so, but the "medicine" part of it requires a lifelong self-discipline that may prove challenging for some, and our use of the word "cure" is not as broad as one could hope. Quantitative medicine indeed cures degenerative disease, but if that degenerative disease has already taken some toll, perhaps a stroke, then that stroke isn't "cured." Quantitative Medicine cannot reverse that. But the risks one associates with aging are very reversible. That is a clock can be turned back. The sooner one acts, the greater the benefit, and the lesser the risk of any damage that cannot be undone.

Calling Quantitative Medicine "prevention" is to short-change it as well. The health attainable by practicing the Quantitative Medicine protocols is our natural state. It means a long, robust, and energetic life. It is the life we lived for countless millennia. The dietary norms of Western society, with its lack of exercise and chronic stress, are the causes of disease. To be well is simply a matter of knowing the healthy choices and adopting them. This is not disease prevention. This is disease evasion.

Degenerative disease proceeds in tiny steps. One cell mutates and divides. Will it grow into a tumor? Not if the correct life choices were made. Those dividing cells will be spotted and eliminated long before they become anything lethal. However, in their short but virulent life, they were a tiny cancer, a tiny tumor, and the body spotted it, and destroyed it. This is repeated in everyone millions of times. Tiny cancers are cured before modern medicine can even begin to detect them.

Likewise, an army of patrolling HDL particles is continuously removing toxic waste from behind artery walls. That waste is the fuel of atherosclerosis, and the body is curing it long before it can cause a heart attack or stroke.

Clearly a person cannot wait until they are 75 to start worrying about the health effects of their lifestyle. Our modern tragedy is that the choices that offer protection and a lifelong cure aren't practiced in our society, even though they could be. Healthy diets can be eaten. Starch is unhealthy; organic vegetables are healthy. For some reason, the government subsidizes the unhealthy one. Healthy exercises can be performed, but useless ones are preferred. We do have a chance to quiet the mind, integrate our wholeness, and dissociate from the swarm of stress we live in, yet those who seek this are ridiculed.

This brings us to two stark choices. We can either wait for our modern society to enlighten and become aware of what it is doing to itself—what we are doing to ourselves, really—or we can take control now, take matters into our own hands, and thereby choose our own destiny, and perhaps alter the destinies of those around us.

We are about to describe degenerative disease in detail. Our fervent hope is that the additional insight into the diseased state unlocks some doors. Those at risk of atherosclerosis can benefit from knowing exactly which dietary choices are promoting the disease, and which circulating biochemicals are actively involved in clearing it out. Such knowledge engenders a healing focus, a focus that can minimize the dangerous and boost the protective. It is enough to simply do the right thing, and this may be sufficient for many. For the terminally curious, the coming chapters take you a step beyond this into the world of *why*.

As in the preceding chapters, much is still unknown.

Personal Story Sidebar

My (Charles Davis') Health Measurement Experience

At age 55 we had our last child, a baby girl. I didn't want to drop dead when she was in junior high, so I went to Dr. Nichols and asked if he could order up a battery of tests to find out what I was all about, and hopefully, fix anything that was broken.

Unbeknownst to me, he was about to start a new practice based on this sort of thing and there I was, his initial Human Lab Rat.

I thought my health was pretty OK. I jogged once or twice a week and was trying to keep my weight down. It kept creeping up year by year anyway.

I was sent for a blood draw, which measured about 70 things, and a scan. I saw the scan results before Dr. Nichols and learned that I had calcium on my heart. This freaked me out. The blood tests were incomprehensible to me.

We met when all results were in and I was told the following:

1. You have borderline osteoporosis. (That was a shocker.)
2. The heart calcium is normal for your age and is the body's way to stabilize plaque, but we want to stop it from increasing.
3. Your cholesterol is a bit high, but you are genetically lucky here and don't have the small sized bad cholesterol particles that clog arteries, so we don't care.
4. You are lousy at metabolizing carbs, so a lot of what you eat gets stored as fat.

All this and more from one scan and a blood draw. He then said all this can be fixed, and I was expecting a bunch of pills, but not at all. He said there weren't any that did what I needed.

To stop and reverse the osteoporosis, I needed to stress the big bones. This causes them to gather in calcium, the absence of which is the cause of the disease. This means squats, deadlifts. Heavy lifting. This went fast. I was out of the danger zone within a few months.

To stop the accumulation of heart calcium, I should do exercises that ran my heart up and down. Exercises of an explosive nature. I should give up jogging, which he said was not very useful. So about the same amount of exercise time, but a totally different routine.

If I behaved, heart disease was off the table. This was the really good news.

I needed to get pickier about the carbs, cut out all starches and most fruit, sticking with meats, fish and colored vegetables.

I have doggedly kept this up and the baby girl is in high school. My bone density is in the top 25% now, meaning if I keep at it I am *never* going to have osteoporosis. The heart calcium has crept up a little, but way less than normal. I've got muscles out to there and all my prior chronic back problems are totally gone. My belly is mostly gone too. I built about 10 pounds of new bone and maybe 10 pounds of muscle, but weigh 10 pounds less than I did 14 years ago, so that's 30 pounds of blubber gone. "Now and then" photos show this clearly.

I am not particularly enamored with exercise, but love the results. No real problems sticking to the diet despite some occasional backsliding. I get a blood draw quarterly and a scan every couple of years. That is probably overkill.

With heart disease not an issue, my main health risk is cancer, and I have already had some problems with that. I am trying to modify my lifestyle to turn up cancer prevention. Time will tell; it's a work in progress.

21 - ATHEROSCLEROSIS - CAUSE AND CURE

Atherosclerosis is the buildup of fatty material and other undesirable detritus within the artery wall. It is an inevitable process, beginning in the womb. However, there are counter-processes at work to manage and reduce this load. Like most degenerative disease, progression is a question of which predominates.

Because of this tipping point property, atherosclerosis can be attacked by reducing the processes that build it up, by augmenting the processes that clear it, or preferably both. Diet, exercise, and stress level affect atherosclerosis in a variety of ways.

Atherosclerosis is, in most cases, reversible, but consequent damage, such as a heart attack, stroke, or embolism, is usually not. Nonetheless, further damage can be prevented.

INSIDE THE ARTERY

Recall that the artery has four layers: a tough outer layer, a layer of muscle, an intermediate fibrous layer, and finally an inner layer, the endothelium, which is in direct contact with the blood flow (lumen).

The endothelium is very complex. Its primary functions are nutrient delivery and waste disposal to and from the body's cells. The various ways that the endothelium accomplishes this were discussed in THE VASCULAR SYSTEM in chapter 18.

The endothelial cells seem to be set up to last forever, with life spans varying from a bit over a month to well over half a century. Why do we care

about cell lifespan? There is a very important reason: when endothelial cells are being replaced, the artery leaks. This leakage is by far major cause of atherosclerosis, and tends to occur in certain areas where cell life is short. Why certain areas are vulnerable and how to counteract that will soon be covered in detail. (Veins don't leak—or at least not much—because unlike arteries, they are not under pressure.)

There is no regularly scheduled replacement program for endothelial cells of the sort we find for the intestinal or skin cells. Endothelial cells are only replaced when they become damaged beyond repair. Such a cell, terminally damaged, could potentially let quite a lot of material—good and bad—leak through. Very quickly, though, the leak will be plastered over with platelets, which will form a partial patch. Platelets are mini-cells, and their best known function is stopping a wound from bleeding. That's exactly what they are doing here, albeit on a very tiny scale. The platelet patches are temporary, and somewhat leaky.

Besides quickly constructing a patch, the platelets also emit SOS chemicals toward circulating replacement cells. (Although the endothelial cells can replicate in place, new cells usually come from individual cells circulating in the blood.) The platelets send out various chemical signals that act like a sci-fi movie tractor beam and pull the replacement cell into place. The replacement stitches itself to the adjacent cells, and the immune system cleans up and carts away the remains.

This all takes around 30 minutes. Fast, but not fast enough. Some stuff does leak through, and in particular, some toxic particles get through that the endothelium would otherwise have blocked had it been intact. Likewise, bacteria, even those which may have already been captured by circulating immune cells, might also manage to get through.

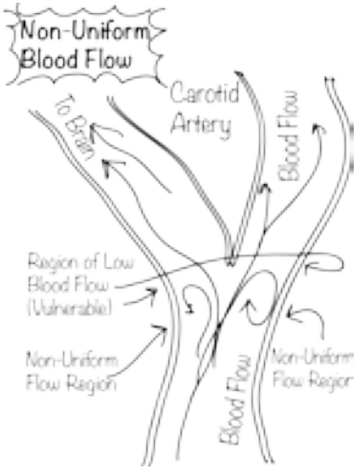
Why are there toxic particles around? Most cells dump their bodily junk back into the bloodstream or else spill it to the surrounding medium. The spills get mopped up by the lymph system, which eventually drains into the circulatory system anyway. So, any toxic junk will circulate until it is removed by the liver or kidneys.

This buildup of toxic trash behind the cell wall is the atherosclerosis. It only happens in arteries, and most of the time, only in certain places. The veins tend to stay out of trouble because they are not under pressure. Arterial pressure can be fairly forceful. The 120/80 sort of blood pressure number

refers to the arteries only, and is quite enough pressure to force blood material through any small holes. Of course, higher blood pressures only make the situation worse. Of more interest, though, is why atherosclerosis seems to set up shop at certain sites. The reasons for this will give us some very useful tools for effectively combating this life-threatening disease.

A Very Short Course in Fluid Mechanics

Fluid mechanics is a branch of civil engineering, and studies how fluids flow. If a fluid flows slowly across a flat surface, it is well behaved, all the fluid goes in the same direction, and all is predictable.



To visualize this, draw a bath, and run your hand slowly through the water. The water is hardly disturbed and flows gently around your hand. Now repeat this, but with rapid motions. Things are no longer well behaved. A wake will form behind your hand and little eddy currents will set up on the sides. This is non-uniform or turbulent flow. Flow is rapid in some areas, but is very slow or may even stop or reverse in others.

Fluid in any pipe, an artery being a pertinent example, will also behave nicely if the flow is slow, but once that fluid starts flowing faster, the flow becomes non-uniform, and in areas where the flow is slow, problems arise. At any bends or branches (the arteries are full of these) the situation becomes a lot worse, and the little swirls that will form have the effect of presenting a slow flow, no flow, or even a reverse flow to certain spots on the artery.

Areas of slow, no, or reverse flow are the common sites for atherosclerosis. There are several reasons for this. First, in order to deliver nutrients to hungry cells, blood must be flowing. If, due to non-uniform flow, the blood is just sitting still, or moving slowly, the cells will not get enough food and oxygen. They will become weak and die more frequently, and when they do, they will leak badly. Second, stress on the cell will be exacerbated by circulating toxins, which are likely to stick on regions of the endothelium where there is minimal blood flow. A regular or rapid blood flow will wash

End of Preview - Thanks for Looking

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