Optimal Health – Understanding Basic Biochemistry

Elizabeth A. Wanek, MD

Optimal health is defined as living well every day, mentally, physically, spiritually, emotionally and sexually, in a symptom-free, disease-free body. Acquiring optimal health is possible by optimizing cell nourishment, because the cell and cell dynamics control the functioning of life in a human body. Cell nourishment happens through organic chemistry, inorganic chemistry, physics, quantum physics, cell biology and biochemistry. There is no magic is these sciences. The food that is consumed, the drinks which are imbibed, the air that is breathed, lotions and oils placed on the skin, and vitamins, minerals, herbs, and pharmaceutical agents taken either internally or externally, are all processed within the human system in a specific, precise, orderly fashion. The consequences of this processing are intended or unintended, supportive or non-supportive of optimal health. Acquiring and applying knowledge in basic science helps reduce the chances for the unintended and non-supportive consequences of human consumption and paves the way to optimal, efficient cellular function.

Beginning with the Renaissance, spanning the 14^{th} to 17^{th} centuries, basic scientists have worked to define human cellular structure and the multiple steps of cellular function, called cell biology and biochemistry. Rapid progress has been made in the last fifty years with the aid of chromatography, mass spectroscopy, radioisotopic labeling, X-ray diffraction, electron microscopic labeling and molecular dynamics. Every day there are thousands of different chemical reactions taking place in the human system, continuously and simultaneously. Additional reactions have been inferred, but have yet to be specifically identified. These reactions provide the energy and the raw materials for the cell machinery to produce things such as enzymes, coenzymes, structural proteins, and message molecules in the form of hormones and neuropeptides, replace cells which are dead or no longer functional and remove the trash accumulated during the manufacturing process. This entire process is called metabolism.

Human cellular metabolism functions according to the laws of homœostasis, a system regulating an internal environment to provide a stable, consistent set of properties, such as blood pressure, temperature, pH, and blood sugar, including continuous cell renewal. Homœostasis is created by equilibrium balance in cellular biochemistry, meaning that for every reaction, there is an equal and opposite reaction. If cell systems are running optimally, blood pressure or temperature or pH or blood sugar goes up, then blood

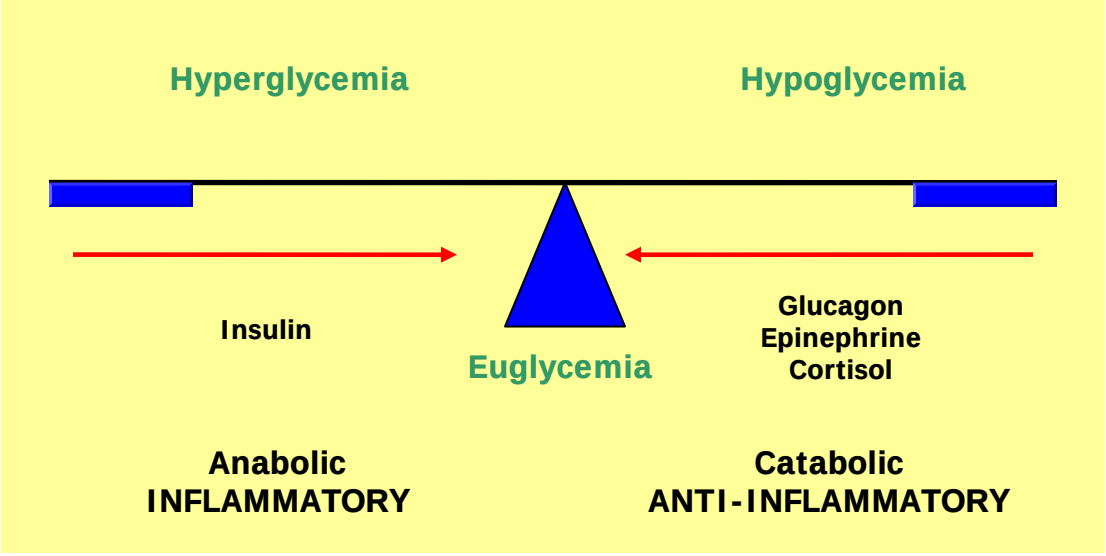
pressure or temperature or pH or blood sugar comes down, always moving toward the center of the equilibrium. With optimal function, as cells become obsolete and die, new cells are regenerated to take their place. Homœostasic mechanisms allow a person to function under a wide variety of circumstances, allowing independence from an energy source and freedom of movement. Cells, not optimally nourished, lose homœostasic capabilities and eventually cease to function.

Maintaining equilibrium balance in cellular metabolism requires a stable, consistent blood sugar level. Blood sugar is a six-carbon sugar named glucose. When blood glucose levels are just right, not too high and not too low, the term is euglycemia. If blood glucose levels are too high at any moment in time, the term is hyperglycemia. When blood glucose is too low at any moment in time, the term is hypoglycemia. If blood glucose levels are too high or too low, cells are damaged and do not function properly. There is a continuous, dynamic dance between blood sugar rising and falling throughout the day. As long as the cells are able to function properly, energy and work will always be expended to return the blood sugar from hyper- or hypoglycemia to the middle ground of euglycemia. The energy and work of metabolism produces heat and electricity, which destroys the very cells that are doing the work. The goal then, is to keep heat and electricity to a minimum.

As the blood sugar is rising, the pancreas makes a hormone called insulin, which brings the blood sugar down through multiple steps that store the extra glucose, first as glycogen in the liver and then as fat in adipose tissue. The amount of glycogen that can be stored is limited by the size of the liver. Fat, however, can be stored in unlimited quantities. Fat is manufactured by removing water from glucose molecules, which makes fat a very light way to store extra fuel. Storing glycogen and fat happens during the anabolic work of the cell metabolism. Chemically, anabolic work takes small molecules and links them together, one-by-one, to make bigger molecules. Anabolism is an essential part of homœostasis. Anabolism brings the blood sugar down. It is during anabolism that enzymes, coenzymes, structural proteins, hormones and neuropeptides are manufactured. Anabolism is the wheels turning side of metabolism. It is the **DAY** side of metabolism. Anabolic work supports the **"INFLAMMATORY"** side of cellular homœostasis. Inflammation is a required and necessary part of metabolism. During

anabolic work, cells resources are being consumed and cell inventory is reduced. During anabolic work, cells die.

As the blood sugar is falling, there are three hormones, glucagon, made by the pancreas, and epinephrine and cortisol, made by the adrenal glands, which bring blood glucose back up. Blood sugar rises initially by breaking down any remaining glycogen in the liver, secondly by breaking down structural protein to create glucose through a process called gluconeogenesis, and finally by adding water back to the fat molecule to produce single glucose molecules. Raising blood sugar levels and breaking down stored fat happens on the catabolic work side of cellular metabolism. Like anabolism, catabolism is an essential and necessary part of homœostasis. Catabolism brings the blood sugar up. Chemically catabolic work takes large molecules and breaks them apart, one-by-one, into smaller molecules. Catabolism is the recycling side of metabolism. It is the repair side of metabolism. It is the resting side of metabolism. It is the **NIGHT** side of metabolism. Catabolic work supports the **"ANTI-INFLAMMATORY"** processes of cellular homœostasis. During catabolic work, cell resources and cell inventory are being replaced and restored. During catabolic work, cells are regenerating.



If the number of hours spent in anabolic work during the day is more than the number of hours spent in catabolic work every day, cell resources and cell inventory are being used faster than they are replaced and cells are dying faster than they are regenerating. If

cell inventory is being depleted faster than it is replaced and cells are dying faster than cells are regenerating, then functional capacity is slowly being depleted and a person is slowly losing the ability to live optimally well, symptom-free every day. This explains, in part, the slow, gradual deterioration in illness and disease. Slow gradual deterioration of cellular function, however, is not required, is not inevitable, and, in fact, is not the design of a human being.

To support optimal health and prevent gradual deterioration and dysfunction, applied biochemistry is used to balance anabolic and catabolic homœostasis by supporting the production of equal amounts of insulin and glucagon with every meal and snack AND meeting the needs for essential nutrients. This is termed insulin/glucagon balance or "**BIOCHEMICAL EATING**." Biochemical eating achieves a blood sugar with very little fluctuation, which keeps the cells happy. Living near euglycemia is a life without an innumerable variety of symptoms, including pain, weight gain, headaches, reflux, constipation, irritability, fogginess, lack of focus, anxiety, lethargy, fatigue, sleeplessness, memory loss or mood swings. When cells are getting their need for a stable blood sugar met, cravings are eliminated. When cravings are eliminated, daily calories are reduced to a minimum, without hunger. When calories are reduced, daily metabolic work is reduced and daily heat and electricity production is reduced, thereby reducing damage to the structure of the human body. Keep in mind that, in addition to minerals, the human body is built from the same thing that drives homoeostasis: proteins, carbohydrate and fats. What does heat and electricity do to minerals and organic matter? Minerals rust. Proteins and fats are smoked and burned and sugar turns into hard candy. Heat and electricity (oxidative stress), dry out and harden cells. Heat and electricity dry out and harden organ systems. All dis-ease is associated with drying and hardening. Reducing the heat and the electricity keeps the cells optimally functional.

Insulin and glucagon are both stimulated by calories and are active at some level twenty four hours a day. All calories, however, do not affect insulin and glucagon in the same way as shown by the chart below.

	Insulin	Glucagon
Carbohydrates	++++	No Change
Protein	++	++
Fat	No Change	No Change
Carbohydrates & Fat	++++	No Change
Protein & Fat	++	++
High Protein/Low Carbohydrate	++	+
High Carbohydrate/Low Protein	+++++++++	+
BIOCHEMICAL EATING Equal Calories from Protein/Carbohydrate/Fat	++	++

Carbohydrate calories stimulate insulin, with no change in glucagon levels. Protein calories alone or protein and fat calories alone stimulate insulin and glucagon evenly. Fat does not change either insulin or glucagon. Carbohydrate and fat calories alone, high protein and low carbohydrate calories alone and high carbohydrate and low protein calories alone, stimulate the production of insulin in greater amounts to glucagon. While protein alone and protein and fat calories meet the criteria for equal stimulation of insulin and glucagon, they do not meet the need for essential nutrients and miss a very important piece of biochemical detail regulating how each type of calorie is processed once it is consumed.

Carbohydrate, protein and fat calories are all required to meet cell needs for essential nutrients. Carbohydrates supply the single sugar molecules, glucose, fructose and galactose. Proteins supply the essential amino acids, leucine, isoleucine, lysine, histidine, methionine, phenylalanine, threonine, tryptophan and valine. Fats supply Omega 3 and Omega 6 polyunsaturated fatty acids. To achieve optimal cell nourishment, no food group can be avoided or eliminated.

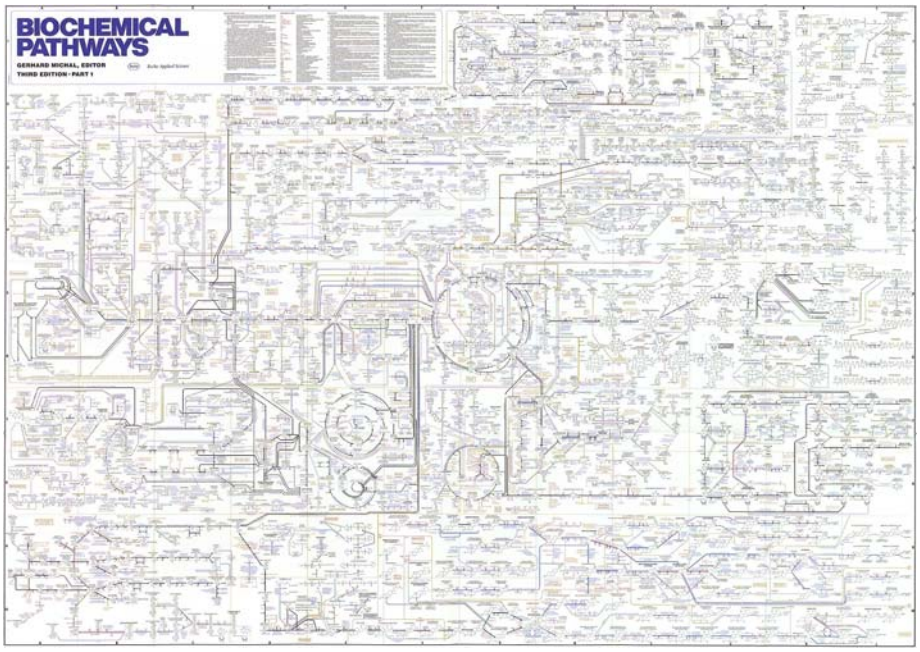
In addition, the processing of calories happens in a very specific, orderly way. Carbohydrate calories are digested and processed within 1-2 hours after they are eaten. Protein calories are digested and released into the bloodstream 2-4 hours after they are eaten. Fat calories take the longest to process, reaching the blood stream 4-6 hours after they are eaten. And, there are only so many calories of each type of food that can be handled at any given interval. If a person eats more total calories or more carbohydrate calories or more protein calories or more fat calories at any given meal than the system can handle, the extra calories will be stored as fat. For the average woman in the basal state, which is living and breathing and walking and talking, it is roughly 120 calories of carbohydrate, 120 calories of protein and 120 calories of fat at any meal. For the average man in the basal state, the number is roughly 180-200 calories of carbohydrate, 180-200 calories of protein and 180-200 calories of fat at any given meal.

Understanding the biochemistry of food processing allows a person to see that protein does not satisfy an instant need for blood glucose because it takes 2-4 hours for protein to fully arrive into the bloodstream. Fat does not serve an instant need for blood glucose as it takes 4-6 hours for fat to fully arrive into the bloodstream. Snacking on protein and fat leads to excess calorie consumption. Eating food period, without paying attention to the biochemistry leads a person down the path of slow, continuous deterioration. **FOOD, consumed without attention to basic science, destroys the cellular machinery and thereby the human body.**

In addition, in accordance with equilibrium balance, equal and opposite reactions cannot occur at the same time. This means that while extra calories are being stored as glycogen or fat, stored glucose calories in the liver and adipose tissue cannot be released!! While extra calories are being stored, however, the blood sugar is falling, which the cells do not like, so glucose is found somewhere else and that is first and foremost from skeletal muscle. As previously stated, glucose can be made from protein if required. So, unless a person is paying attention to eating biochemically, excess calories of any kind are being stored as fat and muscle is being broken down to stabilize blood sugar. This is especially true during exercise. If a person is not paying attention to the biochemistry of food, knowing exactly what and how much is eaten and when it is eaten, exercising muscle will be broken down instead of fat to maintain euglycemia. This

scenario is not efficient because the work of processing food, maintaining energy and maintaining a stable blood sugar is at the very least doubled, creating more heat and more cell destruction, definitely not supporting optimal health.

Cell nourishment and optimal health is not about dieting and inefficient exercise. It is about biochemistry. Cell nourishment begins with biochemical eating. BIOCHEMICAL EATING meets the requirements to sustain and support anabolic/catabolic homœostasis, provide essential nutrients and optimize cellular metabolism, all the while minimizing calories and minimizing metabolic work. Balance carbohydrate, protein and fat calories with every meal and snack to honor the thousands of biochemical processes that are operational within the human system, as shown below.



For it is impossible to micromanage biochemistry. It is impossible to micromanage homœostasis. Optimal blood pressure, temperature, pH and blood sugar are not achieved with pharmaceutical agents, herbal remedies, vitamin and mineral supplements, an alkaline diet or alkaline water. Optimal blood pressure, temperature, pH and blood sugar are the result of coordination of thousands of biochemical reactions within the cells and cell systems, programmed to create and maintain optimal health indefinitely, when nourished, in the purest and most efficient way, by that of which they are made. Weight cannot be controlled by eating less and exercising more, because a calorie is not just a

calorie and exercise done without attention to the science of fuel supply increases the workload and the amount of electricity produced within the system. Vitamins and herbs and supplements neither substitute for biochemical eating nor erase the consequences of non-biochemical eating. The damage is done when the food or the beverage or the drug or the herb or the vitamin or the supplement is consumed without attention to the science! And while the outward effects of the damage take years and even decades to surface, the damage begins in a person months and even generations before conception and continues with each meal, each and every day throughout a lifetime, whether young or old. Antioxidants are weak support indeed, in comparison to not producing the oxidative stress in the first place.

Inflammation and disease is not a mystery. It is not something that just happens, something over which there is no control. The choice for aging and chronic disease is a choice that is made every time food or beverage or supplements or drugs, including herbs and recreational substances, gain entry into the human body, especially unaware of basic science principles and not fully aware of the consequences. Too many people are disconnected from the fact that food consumed creates the function of the body and mind, to constructive or destructive ends. The human system has an unlimited capacity to consume any number of foods or other substances, but not an unlimited capacity to deal with the consequences. Know that the symptoms of homœostasic imbalance turn into cancer and diabetes and stroke and heart disease and arthritis and irritable bowel disease and Alzheimer's disease and fibromyalgia and chronic fatigue and chronic pain. Incorporate organic chemistry, inorganic chemistry, physics and biochemistry into the daily workings of your life. Choose from a position of knowledge, not fear. Choose optimal health. Daily practice makes the choice easier and easier. In fact, with practice, the choice seemingly makes itself.

Elizabeth A Wanek, MD practices "Foundational Medicine"© at The Wanek Medical Center, 6 North Pointe Court, Greensboro, NC. 336 545 1020.