

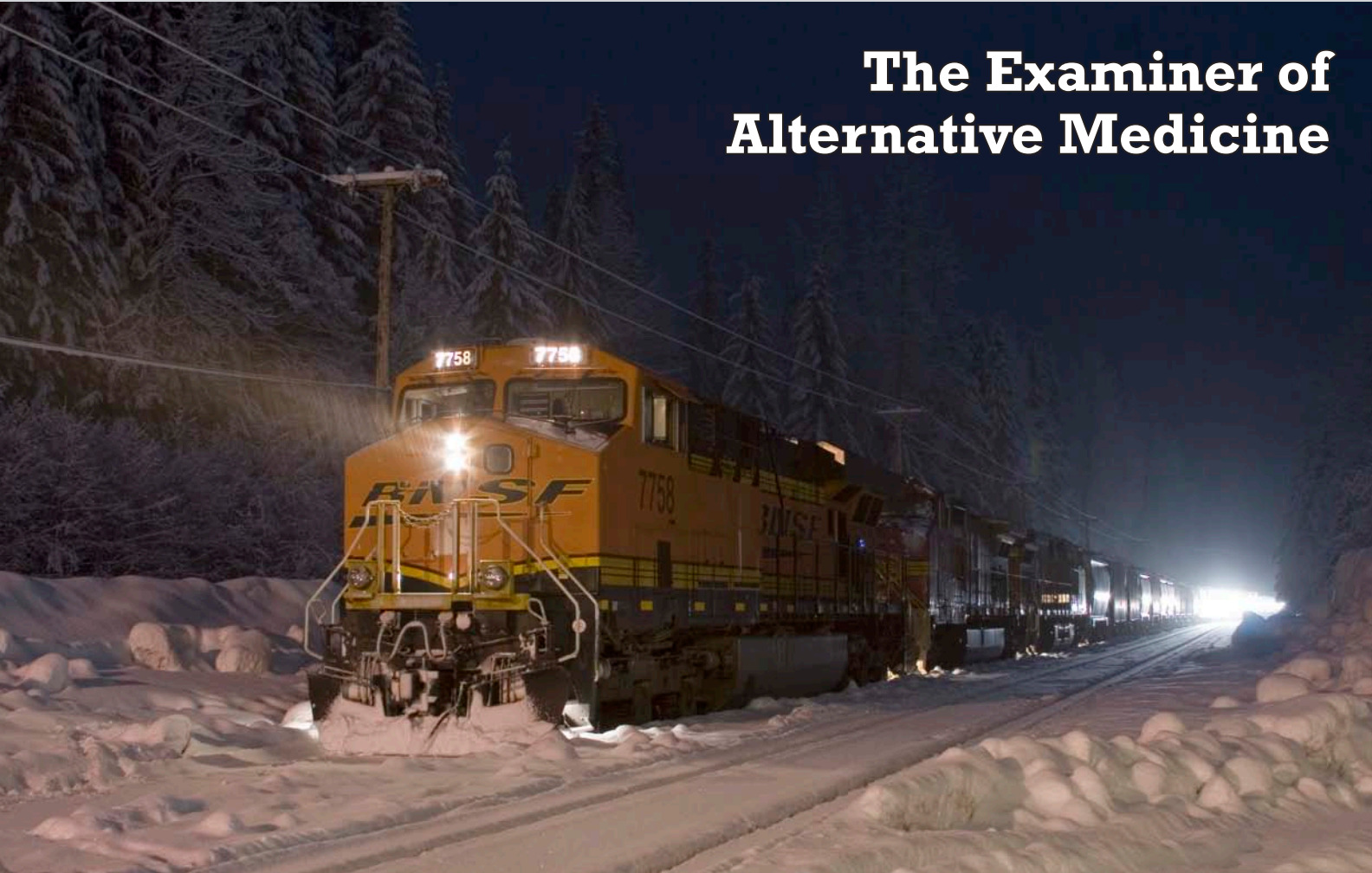
ALTERNATIVE LABORATORY TESTING

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Townsend Letter

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**The Examiner of
Alternative Medicine**



Urinary Neurotransmitters

Biomarker for Psychiatric Disorders

Functional Lab Testing

Scientifically Determining
Supplement Prescribing

Chelating Toxic Elements

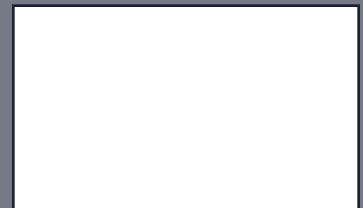
Challenges of Detoxifying Mercury,
Arsenic and Lead

Growth Hormone Secretagogues

Why Growth Hormone May Not Be Good
Medicine

Vitamin D Supplementation

A Cause of
Immunosuppression?



Functional Lab Tests to Evaluate Immune Competencies in Chronic Illness and Chronic Infection

by Russell Jaffe, MD, PhD

Author's note: Parts 1 & 2 of this series appeared in the Jan & Feb/March 2006 issues of *Townsend Letter* (available this month at www.townsendletter.com). This article (part 3) is an update of functional, predictive, sensitive, and specific lab tests. Integrative immune system defense and repair assessments and treatment guides are described.

In previous articles in this series, we reviewed that when healthy, we are tolerant to and resilient in the world outside us. We are resistant to infection and recycle any foreign antigens to which we are exposed. Our immune defense and repair system has the dual responsibilities of protecting us from the outside world and repairing us from daily wear-and-tear.

Capacity of the immune system is finite. Regular and substantial exposure to environmental and food digestive remnant antigens can overload the immune system to an extent that defense becomes the primary role of the immune system and repair gets deferred until the situation improves. Reliable and accurate detection of these antigens is key to understanding the causes of autoimmune, chronic, and degenerative illnesses as well as to assessing the functional status of our health.¹

As Bruce McEwan, a colleague from Rockefeller University, summarizes the dual nature of stress response, "Stress protects under acute conditions, but when activated chronically, it can cause damage and accelerate disease." His text *The End of Stress as We Know It* is recommended to those who want a deeper understanding of stress responses and adaptation to them.

This article extends our series by looking at how what we eat and drink, as well as what we think and do, impact our health. Emphasis is on understanding, assessing, and getting feedback from the immune system. This allows us to know if our immune defense and repair system is getting the essential nutrients and other factors needed to keep an alkaline reserve, protect from oxidative stress, and communicate homeostatic balance in the integrated control system known as the psycho-neuro-immuno-hormonal system. The gut and central nervous systems are regulated through this higher, integrative control system.

Galen and Gambino's *Beyond Normality* called attention to the strengths and limits of comparing people to lab values based on "usual" statistical ranges in the mid-70s (Galen R, Gambino S. *Beyond Normality: The Predictive Value and Efficiency of Medical Diagnoses*. New York:Wiley; 1975). Comparing people with *themselves* has been found more predictive of helpful outcomes and is fundamental to the emerging paradigm of integrative health care. Personalized care has stimulated development of functional metabolic, immune, hormonal, and neurochemical tests. Integrative medicine uses these tests with a focus on redressing causes to achieve the fullest possible health restoration or sustained remission for each individual. More conventional use of the tests is to assess symptomatic consequences that can form the basis of a "symptom suppressive" care model. This is an extension of the biochemical individuality concept developed by Roger Williams and Emanuel Cheraskin, MD, DMD.

The Immune System Defines Who We Are in Relation to the World Around Us

Immune system functions are so pervasive that they are fundamental to overall health and well-being. This article emphasizes tests and their clinical meaning as well as the essential nutrients commonly needed to sustain healthy immune system functions. When robust and healthy, our immune system repairs us from daily wear-and-tear, leaving us resilient to the challenges of life. In addition, the immune system is charged with identifying and marking for elimination any abnormal cells that form anywhere in the body. Further, neutralizing any foreign invader is a core responsibility for health maintenance.²

Infectious or Not, All Foreign Invaders Are Treated the Same

All foreign invaders in the body are treated the same, which means digestive remnants and infectious agents are dealt with identically by the immune system; they are both "not self" and therefore must be recycled. If first responder cells fail, if recycling becomes overloaded, then reserve

immune system components are called in to adapt an offensive response to the invasion.³

Given that two-thirds or more of the body's entire immune system is in the intestinal lining (or Peyer's patches, as they are known), this suggests the importance of interactions between the gut and the control system of the body. This also means that when our immune system is preoccupied with digestive remnants and intestinal antigens that enter through a "leaky" or under-repaired intestinal wall, it is more hospitable to infectious agents to which people are exposed. In other words, if our immune system is not able to recycle the invader through dendritic cell actions nor neutralize it through lymphocyte responses, the infection may be able to hijack our energy systems to feed itself at our expense.

Autoimmune, chronic and degenerative illnesses emerge, depending on which system or systems are most stressed. Too many depend upon our reserve forces for daily function and survival. Examples are given below. Restored homeostasis and sustained remission is highly likely.⁴

Homeostasis First: Effective Dendritic First Responders Protect and Defend

"Deficit in any essential nutrient leads to dysfunction in entire system(s) that depend upon that nutrient."

Justus Baron von Leibig (1837)

"Lack of anything essential makes the whole system dysfunction."

paraphrase of von Leibig

by Russ Jaffe, IAACN Annual Meeting 1990

When healthy, people have self-restoring core systems that rebalance and keep them resilient, tolerant, and feeling well. Known as homeostasis, this reflects our biological bank account to which we can deposit and from which we can withdraw until we become overdrawn. Overdrawn in this context means we are deficient in essential nutrients, unable to detoxify internal and external xenotoxins, or imbalanced in stress responses.

When challenged, our first responders are dendritic cells of many subtypes, with specific dendritic cells for each specialized system in the body along with circulating surveillance cells. Dendritic cells protect and defend and are motile and multi-functional. They include mast cells, monocytes, granulocytes (polys), fibroblasts, endothelial cells lining blood vessels, Kupffer Cells in the liver, sinusoidal cells in the spleen, astrocytes and glial cells in the brain.⁵ While often under-appreciated, dendritic cells perform the following:

1. Take up xenotoxins first to protect more delicate systems. This also makes them exquisitely sensitive to xenotoxin bioaccumulation.
2. Detoxify harmful chemicals in their mitochondrial cytochrome and cytosol phase 1 & 2 detoxification systems

3. Repair basement membrane and other structural proteins, e.g., collagen, elastin, and related glycoproteins
4. Circulate to sense healthy and cancer cells so that the abnormal cells can be deleted
Cancer can only occur when innate anticancer mechanisms have become dysfunctional.
5. Have high requirements for essential nutrients that are commonly used up and become deficient such as the following:
 - a. Hydration as assessed by skin pinch and release test
 - b. Omega 3s (EPA, DHA, CLA) essential fatty acids with 1-3 grams daily recommended divided among all three needed omega 3 EFAs
 - c. Buffering minerals, particularly magnesium, and including concurrent choline citrate to facilitate magnesium uptake, sufficient to keep first morning urine pH in the healthy 6.5-7.5 range (Figure 1)
 - d. Protective antioxidants such as ascorbates, based on the individual ascorbate calibration protocol, quercetin dihydrate flavonoids (0.5-5 gm/day), and soluble OPC flavonols (5-50 mg/day) equal to a full day's servings of fruits and vegetables to provide ORAC free radical protection and prevent oxidative stress
 - e. L-Carnitine fumarate (250-1000 mg/day) in micellized in medium chain triglycerides to facilitate fat metabolism.
Carnitine is the shovel that brings the fat fuel to the cell furnace in the mitochondria.

Tolerance and Homeostasis Lost: Dendritic Exhaustion Calls for Reserve Responses

"While healthy people have a tenfold reserve in most systems, it is increasingly easy to overwhelm and exhaust personal health reserves."

Len Duhl, personal communication, 8/8/08

The first sign that our immune system is wearing down is that innate immune system dendritic cells call for reserve immune system components to mount an acquired response. This means that repair is deferred, and foreign invasion, beyond what can be neutralized by available dendritic cell resources, becomes increasingly common.

Such acquired immune responses have become so common that it is uncommon to meet someone able to reply upon their dendritic cells for defense and repair functions without calling for antibody or T-cell lymphocyte backup.

Functional deficits in dendritic cell action occur only when the following take place:

1. Essential nutrients are in deficit as outlined above and detailed below;
2. Xenotoxins, including biocides, medications, solvent residues, and/or toxic minerals, come in beyond the



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- adaptive capacity of the dendritic cells to metabolize and detoxify them;
3. Learned distress has overwhelmed control system hormonal and neurochemical balance, causing relative cortisol and adrenalin excess.

Acquired Immune Responses: Mucosa to Marrow

"From garden to table, from farm to fork, we deserve safer, more nutritious, health-promoting foods."

Beatrice Trum Hunter
Nutrition for Optimal Health Association (NOHA)
Chicago, Illinois, May 1978

When dendritic cells can no longer handle the immune systems workload, they call upon adaptive responses. Dendritic cells process and present the foreign antigen to be reacted against to naïve, CD3 lymphocytes. Based on the Gel and Coombs nomenclature introduced in 1967, these can be antibody (B cell/plasma cell, type 2) or Immune complex (type 3) or T-cell (Th1 or Th2 dominant, type 4) responses.

Collateral Effects: Metabolic, Hormonal, and Neurochemical

"The control system of the human body is known as the governing vessel in traditional Oriental medicine and the psycho-neuro-immuno-hormonal system in Western science."

Russ Jaffe to Xing Wu and Maurice Mussat Wainright House
Symposium on Acupuncture, April 1977

Whenever immune responses are stressed, there are consequences for the metabolic, hormonal, and neurochemical aspects of the control system. This is because the immune, hormonal, and neurochemical systems are parts of a common governing system in the body. This means that anything that influences any of the three components influences the other.

Acronyms and Abbreviations

CFIDS = chronic fatigue immune dysfunction syndrome
d-pen = d-penicillamine provocative tests for essential and toxic minerals,
DHEA = dehydroepiandrosterone
HPA = hypothalamic pituitary adrenal feedback system
LRA by ELISA/ACT = lymphocyte response assay by enzyme-linked immunosorbed assay and advanced cell culture based on kinase enzyme activation
MCT = medium chain triglycerides that help alkalize the body
MELISA = modified enzyme linked immune system assay by radio-labeled thymidine uptake
NAE = Net acid excess; reflects balance in days acid-alkaline status
NK = natural killer
PAK = pyridoxal-alpha-ketoglutarate
pH = log of hydrogen ion
POPs = Persisting organic pollutants

Tolerance and Homeostasis Lost: Exhausted Dendritic Cells Call for Help from Acquired Lymphocyte Responses

"Intolerance and hopelessness are routed in a loss of homeostatic feedback in those who lack the practices to restore balance when it is lost."

Bhante Dharmawara
World Future Society Meeting on Future Scenarios in Health
Toronto, Canada, 1979

When healthy, any foreign immunoreactants or "antigens" that gain entry are promptly identified, engulfed, and recycled by our ample supply of dendritic (phagocytic) surveillance cells.³⁻⁶ The types of foreign antigens that the immune system is responsible for neutralizing when we are healthy – or addressing when our immune defenses are burdened – are generally glycoproteins or lipoproteins and include the following:

1. Infectious agents,
2. Inhaled pollen or aeroallergens,
3. Digestive food remnants,
4. Pathogenic dysbiotic organisms and parasite antigens.

In contrast, when burdened by maldigested antigens or antigens from dysbiotic intestinal pathogens and parasites, our immune defenses are less able to neutralize infectious or aeroallergen antigens and haptens.⁶⁻¹⁵ In this circumstance, our body defers needed repair, develops inflammation as a result, and expresses the signs and symptoms of delayed allergic autoimmune and immune dysfunction pathologies¹⁻⁶ that became, in the nineteenth century, the basis for our descriptive, symptom-oriented, conventional health care system.⁶⁻⁸

Tests of Immune System Function and Their Clinical Meaning

"Trust yet verify"
President Ronald Reagan, 40th President of the United States

The tests described are those with the highest predictive significance, with better sensitivity and specificity. In general, this means the functional and person-specific tests and assessments, as described here and in the next section. Conditions that benefit from these tests include autoimmune, chronic, and degenerative diseases. This includes the autoimmune conditions specific to each part of the body before they were understood as having a common set of causes in immune system-acquired self-attack.⁹

Autoimmune chronic conditions include the following:

1. Diabetes (both type 1 and type 2) and its precursors, obesity, and metabolic syndrome
2. Rheumatoid arthritis in the joints
3. Asthma and pneumonitis in the lungs
4. Irritable bowel syndrome, regional enteritis, and ulcerative colitis in the intestines
5. Eczema and psoriasis in the skin
6. Multiple Sclerosis in the brain

7. Uveitis in the eyes
8. Autoimmune myositis in the muscles
9. CFIDS and fibromyalgia
10. Hepatitis and other inflammations of the liver

Chronic and degenerative conditions include the following:

1. Cardiovascular conditions, from coronary artery diseases to atherosclerosis and arteriosclerosis in the heart and blood vessels
2. Osteoarthritis in the joints due to cumulative repair deficits
3. Osteopenia and osteoporosis in the bones due to NAE
4. Cataracts in the eye
5. Enteropathy in the digestive track
6. Immune dysfunction syndromes

Specific tests of immune function include the following:

1. **Inflammation** can be measured through any of the inducible protein systems of the body, from Sedimentation rate (Sed Rate), to fibrinogen, ferritin, microglobulin, prealbumin, C-reactive protein (CRP), or tumor necrosis factor (TNF). Inflammation is cumulative repair deficits. The more affected area of the body is the one with the most accumulated wear-and-tear or distress.
2. **Phagocytic Index** for function of dendritic cells measures how many organisms a granulocyte can engulf under standard conditions. Healthy dendritic cells can typically take up 50 organisms per cell.^{6-10,16}
3. **Reactive immunity** is evoked when innate passive immunity based on dendritic cells is asked to do more than they can handle:
 - a. **Acute (type 1, immediate hypersensitivity):** IgE antibody measurable by RAST (serum) test or by skin prick tests reflecting the histaminic, reaginic, or Ishizaka responsiveness. This is all that conventional skin testing measures. Our experience is that type I responses reflect overload of immune responses. When the immune system is restored to homeostatic resilience, type 1 reactions usually abate as IgG4 antibody levels increase to balance the IgE.
 - b. **Delayed late phase reactions due to reactive but not neutralizing antibodies (type 2), immune complex (IgM anti-IgG antigen complex, type 3), and T-cell-mediated (type 4) hypersensitivities or delayed allergies** can be best measured by functional lymphocyte response assays such as **LRA by ELISA/ACT** and **MELISA**. They are the current state-of-the-art tests of comprehensive delayed hypersensitivity, delayed allergy tests for foods, and environmental chemicals (Figure 2).

Initial antibody responses are IgM. They are strong yet short lived, typically three to six months. In contrast, IgG and IgA in serum and secretory IgA in

mucosal secretion (IgA) appear months after initial antigen exposure but carry that memory through the lifespan as long as the immune system remains healthy and resilient.

Delayed allergy mechanisms addresses the basic burden on immune defense and repair systems. The more attention to defensive reaction from delayed allergies, the less ability the immune system has to devote to necessary repair. Cumulative deferral of repair results in increased permeability in tissues that have the greatest wear-and-tear – those that are distressed. Cumulative repair deficits are clinically known as inflammation. Fundamentally, we can understand inflammation as incomplete or blocked repair.

Functional, comprehensive, ex vivo assessment of all delayed allergy mechanisms: LRA by ELISA/ACT tests are unique in that they measure all delayed allergy pathways. This lymphocyte response assay (LRA) is functional. This means immune memory lymphocytes (both B- and T-cells) respond to potential reactants under laboratory controls. For example, beneficial, protective, neutralizing IgG antibodies are not detected while harmful, reactive, complement-activating IgG antibodies are detected. This is in contrast to serum ELISA IgG or EIA tests that detect the presence of an antibody but do not assess if the antibody function is neutralizing and helpful or complement fixing and harmful.

The LRA by ELISA/ACT tests are comprehensive in that B-cell-mediated antibodies, immune complexes, and T-cell-mediated reactions are all measured. Performed in CLIA certified facilities, these assays have exceptional reproducibility and clinical predictive significance. Further, the LRA by ELISA/ACT tests are *ex vivo* in that the cells react just as they do in the body yet under direct laboratory observation.

Reproducibility of LRA by ELISA/ACT on split samples is unusually consistent, being greater than 98% at least to pass quality control. With over 5,000 split samples analyzed, the consistency of the LRA by ELISA/ACT is dramatically different from any other lymphocyte response assay. This is because of the added improvement in signal-to-noise ratio afforded by the novel ELISA part of ELISA/ACT, which uses the lymphocyte as the source of enzyme amplification. Day-to-day variations in LRA by ELISA/ACT results are greater than 97% reproducible. This is excellent for any assay and particularly for a cell response assay. Part of the assay robustness is due to averaging the results from thousands of cells in the assay (data on file and available at www.elisaact.com).



Functional Lab Tests

► Immune System Essential Nutrient Needs and Their Clinical Meaning

“Biochemical Individuality... Your beautiful world within.”
 Roger Williams
 President of the American Chemical Society Director
 Clayton Medical Foundation, 1959

From antioxidants to buffering minerals, from xenotoxins to detoxification mechanisms, from measures of net acid excess (NAE) to digestive competence, from hormonal balance to vitamin levels, the following tests provide essential insights into immune system functions in humans and related higher primates, including Orangutans and Bonobos.¹⁷

1. **Ascorbate calibration** as measure of ReDox, methylation efficiency, and inflammation or repair deficit.¹⁸

Vitamin C is nature’s most potent and safest antioxidant cofactor. While it is not technically a vitamin (vital amine), ascorbate aids in the maintenance of cellular membranes, cellular respiration, the peroxidase cleansing system, and the restoration of vitamin E, selenomethionine complexes, and sulfhydryl enzymes such as glutathione synthetase, thereby helping to detoxify various drugs and chemicals. These same systems are vulnerable to overload from environmental chemicals that deplete essential antioxidant intermediates such as glutathione, ascorbate, or co-enzyme Q10.

Ascorbate is also required for hormone biosynthesis and to maintain the integrity of connective tissue, capillaries, bones, joints, muscles, and teeth. Ascorbate is essential in wound repair and tissue healing.

Ascorbate has been shown to increase cellular resistance to many common viral infections (most probably due to its interferon-like activity) and enhance specific parameters of immune function. All these actions of ascorbate are related to its antioxidant or reducing or electron-donating abilities. Rapid consumption of ascorbate occurs in cells of people with chronic conditions like fibromyalgia muscle pain, CFIDS, and other chronic immune dysfunction conditions.³⁰

We recommend individualized calibration of ascorbate need to achieve beneficial cellular ascorbate levels (Figure 3). Ascorbate calibration¹⁷ is a functional test that measures antioxidant need and turnover and is thus a functional measure of oxidative stress. Based on ascorbate calibration, it is evident from Figure 3 that 80% of people require at least 10 g of ascorbate daily for optimum physiological function, and this amount can be as high as 130g/day.

2. **D-penicillamine tests for essential and toxic minerals:** measurement of buffering minerals using such standardized and validated protocols such as the d-penicillamine provocation tests for both essential and for toxic minerals¹⁹ (Tables 1 and 2)

The advantage over other provocative agents is twofold:

- a) Forty years of experience with the safer use of penicillamine in treating copper mineral overload as well as for radioprotection
 - b) *Only* this assay provides information about the essential nutritional minerals. Other agents are selective; penicillamine picks up all divalents.
3. **First AM urine pH** for assessment of metabolic acidosis

Eating foods that can be digested completely without triggering local or systemic immune responses is helpful. During repair or recovery phase, this means 80% by volume eaten of alkaline-forming foods. These are easier to digest while providing bulk and essential nutrients in contrast to acid-forming foods that provide dense calories but low nutrient density.

Eating “The Alkaline Way”¹⁹ concurrently energizes and detoxifies the body so that cell metabolic systems are restored to their efficient, resilient states. The chart in Table 3 of food effects on body chemistry is useful in implementing “The Alkaline Way” in daily practice. The preferred alkaline-forming foods are on the left side; the acid-forming foods are on the right side.

A healthy, alkaline biochemical balance is important for all bodily functions. A good clinical assessment of sufficiency of buffering or of net acid excess (NAE) is attained from measurement of first morning urine pH with a healthy range of between 6.5-7.5.²⁰

Table 1: Mineral value ranges for nutritional and toxic minerals in second-day 24^o urine after d-penicillamine provocation, 7.5 mg./Kgm; q.i.d. for three days [N=200]

Mineral element	Reference Range mg. /gm Creatinine	Reference Range mg. /24 ^o sample
Nutritional Minerals		
Calcium	310 - 620	400 - 900
Magnesium	250 - 550	350 - 700
Zinc	0.8 - 1.3	1.1 - 1.5
Copper	0.04 - 0.06	0.06 - 0.08
Iron	0.20 - 0.30	0.24 - 0.36
Manganese	0.005- 0.007	0.006- 0.008
Molybdenum	0.11 - 0.14	0.13 - 0.19
Boron	4.1 - 5.6	5.8 - 6.7
Chromium	0.19 - 0.30	0.21 - 0.33
Cobalt	0.04 - 0.06	0.05 - 0.07
Selenium	0.25 - 0.31	0.24 - 0.35
Vanadium	0.02 - 0.03	0.03 - 0.04

Note: Values lower than the reference range in provoked specimens suggests deficiency of the above needed essential minerals. Adequacy of supplemental intake to replenish deficits can be monitored by repeat d-penicillamine provocation every three months.

Human cells are optimized around a narrow pH range. Even small (hundredths of a pH unit) shifts to the acid or alkaline sides that are uncompensated induce substantial loss of cell efficiency in energy production, protein synthesis, essential transport, and overall metabolic competence.

Saliva is a useful tool in people with healthy gingiva. If gingiva is not healthy, the serous fluid exudate makes saliva pH no longer representative of NAE. Clinically, first morning urine pH is the more reliable specimen for determining NAE.²¹

4. First AM **urine specific gravity** to assess kidney concentrating capacity

First AM urine concentrating capacity (specific gravity) is the best early measure of how healthy the kidneys are through measuring their concentrating capacity. The role of the kidneys is to aid in the clearance of toxins, toxicants, and metabolic waste. The body excretes some of these waste molecules via urination, and the role of the kidney is to concentrate the urine, so that such waste molecules can be excreted with minimal loss of water and nutrients. A urine-specific gravity of $>1.02\text{g/ml}$ is a sign of healthy functioning kidney tubules and glomerulae. The interpretation of other kidney function parameters like BUN and serum creatinine is also influenced by the specific gravity of the urine.

5. **Digestive Transit** time assessment via charcoal capsules

A healthy "transit time" from food consumption through digestion, assimilation, and waste elimination is an efficient 12-18 hour interval. We can use transit time measurements as an overall assessment of digestive health. This can be done easily with the use of charcoal capsules. In general, 10-12 charcoal capsules (Requa) are taken on an empty stomach with water. The start time is noted. When "black stuff" is noted in the stool, the completion time is noted. The difference in hours is the transit time.²² Detailed stool digestive analysis tests are indicated if the transit time is either too long or too short.

Restoration of digestive competence if transit time is > 18 hours

Restoration means redressing the causes of maldigestion, dysbiosis, mucosal inflammation, and enteropathy, which includes the following:

- a. Eating foods that can be more completely digested without triggering focal or systemic immune responses. This can be based on self-tests or on comprehensive, functional tests of food and chemical hypersensitivity such as LRA by ELISA/ACT and MELISA.
- b. Eating in ways that enhance the digestion of food to healthy building blocks. These building blocks include amino acids, di- and tri-peptides, sugars, glycerides, and fatty acids.
- c. Replenishing a probiotic healthy microflora with 20-40 Bn viable organisms daily

A full range of healthy probiotics is needed along with dietary or supplemental prebiotics. **Prebiotic fiber**, 40-100 gm/day, is preferred in the 80% soluble and 20% insoluble proportion; beta-glucan-rich forms are able to bind and remove toxins while nourishing the probiotic beneficial organisms.

- d. Stimulating repair of intestinal capacity and rebuilding areas of focal intestinal atrophy (enteropathy), which means providing energy for repair from l-glutamine (best recycled with the benefit of PAK [pyridoxal-alpha-ketoglutarate] to avoid glutamine build-up outside cells as excitoneurotoxins). This also means enhancing efficient removal of environmental toxins, from toxic minerals to hormone mimic biocides to solvent residues. This has the benefit of staying within physiologic levels and avoiding glutamate build-up outside nerve cells.

We suggest 1.5 gm l-glutamine combined with 0.5 gm PAK taken on rising and before bed on any empty stomach. Additional doses can be beneficial 30-60 minutes before exercise or "work-outs." Note that adding pyridoxine (B6) to alphaketoglutarate does not work as an alternative.

- e. Secretory IgA (sIgA) as measure of mucosal immune status

Atrophy of intestinal wall surface area and diminished healthy intestinal mucosal immune defense mucins and secretory IgA antibodies are among the functional losses of immune status. If transit time is shorter than 12 hours, hypermotility and attended decreases in nutrient uptake should be investigated.²¹

6. **Vitamin Profile** to include the following:

- a. Vitamin A, retinols in plasma,
- b. Vitamin Bs by enzyme kinetic assay in whole blood,
- c. Vitamin C by oral ascorbate calibration,
- d. Vitamin D or 25OH-cholecalciferol in plasma
- e. Vitamin E or tocopherols in plasma and oxidized LDL in urine,
- f. Fatty acid analysis from red cell membranes, analyzed at the Kennedy-Krieger Lab of Johns Hopkins University,
- g. Iron, TIBC, and ferritin in serum.

7. **Adrenal** / HPA Axis assessment of hormone rhythm and balance: free cortisol / DHEA (saliva or plasma taken on rising, mid-day, late afternoon, and before bed to assess adrenal response).

In a recently concluded assessment, we were able to show improved adrenal stress indices (ASI) after just six weeks on a unique, comprehensive combination of Rhodiola, Phellodendron, Magnolia micellized in perilla oil, and MCT. This improvement occurs sooner than in most hormone studies, which require six months or more to show benefits.²³ Striking improvement in glucose/insulin energy regulation concurrent with improved

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Table 2: Toxic Minerals

Toxic Minerals	µg/gm Cr	µg/24 ^o sample
Lead	< 20	< 25
Mercury	< 7	< 9
Arsenic	<120	<175
Nickel	< 16	< 25
Cadmium	< 4	< 6

HPA axis (cortisol/DHEA) function was also observed in our studies confirming the direct link between adrenal fatigue (cortisol / DHEA dysrhythm) and glucose / insulin energy regulation (Figure 4).^{23,24} Figure 5 illustrates a case example wherein improvement in the cortisol DHEA ratio coincided with glucose and insulin regulation.

8. **Thyroid hormone function tests:** Free T3, Free T4, and TSH to assess thyroid hormones plus anti-thyroid antibody studies if thyroiditis is suspected

Healthy TSH is 0.5-2.5 IU/ml. Autoimmune thyroiditis is increasingly recognized and appears to be more common in people with thyroid dysfunction in the twenty-first century than in the twentieth century.

9. **Oxidative Stress and methylation:** Homocysteine (healthy values are < 6 mg/dl in plasma) and oxidized cholesterol, oxidized LDL, and 8-oxo-guanine are undetectable in healthy urine because of antioxidant protection and thus lack of oxidative damage.

10. **Detoxification** pathways can be measured via their products.

Hippurates reflect glycine status; glucarates reflect d-glucaric acid conjugation; mercapturates reflect thiol or cysteine conjugation; sulfates are an additional detoxification conjugation pathway. These different mechanisms for making toxins more water-soluble and less generative of free radicals are our detoxification systems.

Sulfites (urine) are not present in healthy people. Sulfite presence in the urine reflect molybdenum deficit, as the sulfite oxidase enzyme is molybdenum-dependent.

Case Example

WC was a typical 50-year-old, a successful Latino male teacher, father of five (four living), who presented with a long history of labile hypertension, intermittent sleep and mood disorders, and an anxiety about his future. The medical, social, environmental, and family histories were unremarkable.

Self tests revealed the following:

1. First AM urine pH was consistently 5-6, despite following an alkaline way diet for three months.
2. Transit time was observed at 136 hours. Follow-up comprehensive stool digestive analysis revealed

dysbiosis (three pathogens, sensitive to garlic and ginger), maldigestion particularly of fats and protein, as well as evidence of enteropathy and altered mucosal uptake as a consequence.

3. Ascorbate calibration determined that 30 grams were needed to calibrate. Weekly calibrations were repeated while he maintained a daily intake at 75% of calibration amount to satisfy daily needs.
4. D-penicillamine provocation tests for nutritional and toxic minerals revealed a deficit in magnesium and an excess of arsenic and lead. Biological detoxification was carried out and d-penicillamine added on Monday and Thursday for three months at 7.5 mg/kgm QID. In addition, ionized magnesium salts and choline citrate were given (three to six doses daily) to restore and maintain first AM urine pH in the healthy 6.5-7.5 range.
5. LRA by ELISA/ACT tests were performed. Reaction to propyl gallate, gluten, and sulfite were found. After careful counseling about hidden sources and exposures to reactive items, WC agreed to substitute for reactors for six months, following an immune-tolerance resetting program as part of his healing.

Based on the above tests and self-assessments, WC was started on comprehensive supplementation to improve magnesium uptake through concurrent choline citrate administration, adrenal, digestive prebiotic and probiotic flora as well as recycled glutamine to stimulate repair. Detoxification assessment revealed selective deficit in mercapturates. Increase in sulfur-rich foods were then included including daily choice of one or more of ginger, garlic, onions, brassica sprouts, and eggs.

Over a six-month period, WC found himself more resilient, reported improved restorative sleep, and was more hopeful about his life. Follow-up tests revealed the following:

1. First AM urine pH returned to and remained in the goal range of 6.5-7.5.
2. Transit time improved to 24 hours.
3. Ascorbate calibration reached a peak value of 50 grams after two months and had reduced to 12 grams by the end of six months.
4. D-penicillamine provocation showed the magnesium deficit had been corrected and that lead and arsenic were no longer detectable although increase in cadmium excretion was observed and detoxification continued for another six months.
5. LRA by ELISA/ACT tests revealed loss of reactivity to gluten and sulfite. Continued reactivity to propyl gallate was observed. On investigation, certain personal care products containing propyl gallate were found and discontinued; products not containing this chemical were substituted.

Continued on page 88 ➤

Table 3:

Food & Chemical Effects on Acid / Alkaline Body Chemical Balances

Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods	Acid-Alkaline Balancing Foods
<ul style="list-style-type: none"> Black Sesame Mineral Water 	<ul style="list-style-type: none"> Green Tea Black Tea Herbal Tea 	<ul style="list-style-type: none"> Apple Cider Vinegar Apple Orange 	<ul style="list-style-type: none"> Apple Cider Vinegar Apple Orange 	<ul style="list-style-type: none"> Apple Cider Vinegar Apple Orange 	<ul style="list-style-type: none"> Apple Cider Vinegar Apple Orange 	<ul style="list-style-type: none"> Apple Cider Vinegar Apple Orange 	<ul style="list-style-type: none"> Apple Cider Vinegar Apple Orange
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Functional Lab Tests

➤ WC reported that he had lost 19 pounds without caloric restriction. He also reported himself to be more at ease and less reactive to stressful situations. Overall, he reported that he felt 10-15 years younger and was able to exercise more “because I feel so much better.”

Conclusion

Each person has a specific set of conditions and requires nutrients at dosages to best meet their individual utilization rates or half-lives. The information above provides functional, state-of-the-art methods for determining individual needs based on causes rather than consequences. This makes it possible for people to take a more active role in their health and have actionable information available to them, particularly with the experience and interpretation provided by knowledgeable health professionals.²⁴⁻³¹ We can now use integrative medical approaches based on global evidence databases and clinical experience as detailed in this article. This article is dedicated to those who want to live well and happily.

Resources

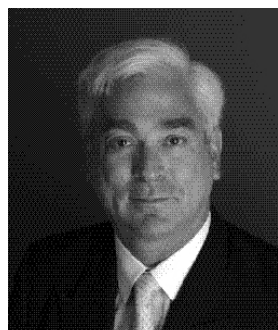
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Dr. Jaffe is Senior Fellow of the Health Studies Collegium research foundation. He is the developer of the LRA by ELISA/ACT tests and plans, the d-penicillamine nutritional and toxic mineral assessment protocol, the ascorbate calibration protocol, dose-response platelet aggregation, an occult blood method not interfered with by ascorbate reducing substances, among other contributions to biomedical science. He serves as director of ELISA/ACT Biotechnologies, LLC and PERQUE, LLC, nutritive supplements.

Dr. Jaffe is recipient of the International Scientist of the Year 2003, awarded by the International Biographical Commission of Cambridge, England, to recognize his contributions to Biochemistry, Clinical Medicine, and Immunomics. He was recently elected as a Fellow of the National Academy of Clinical Biochemistry. He also maintains Fellow status in the American Society for Clinical Pathology, American College of Nutrition, and American College for Allergy, Asthma, and Immunology. He is a certified clinical nutritionist (CCN).

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Figure 1: Influence of Choline Citrate on Ionized Magnesium Uptake

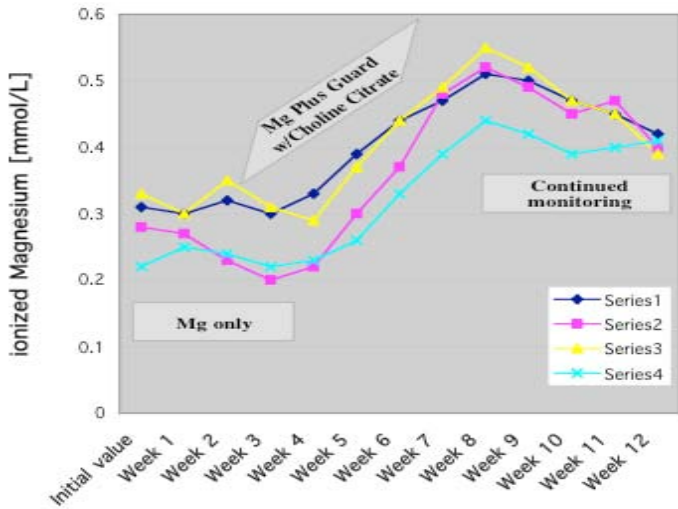
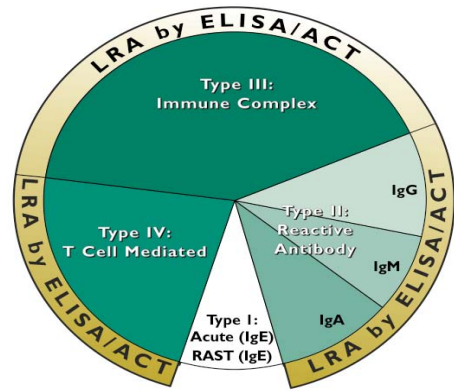


Figure 2: Functional Lymphocyte Response assays (LRA) Are Able to Measure All Delayed Allergy Responses



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Figure 3: Individual Ascorbate Need Based on Calibration

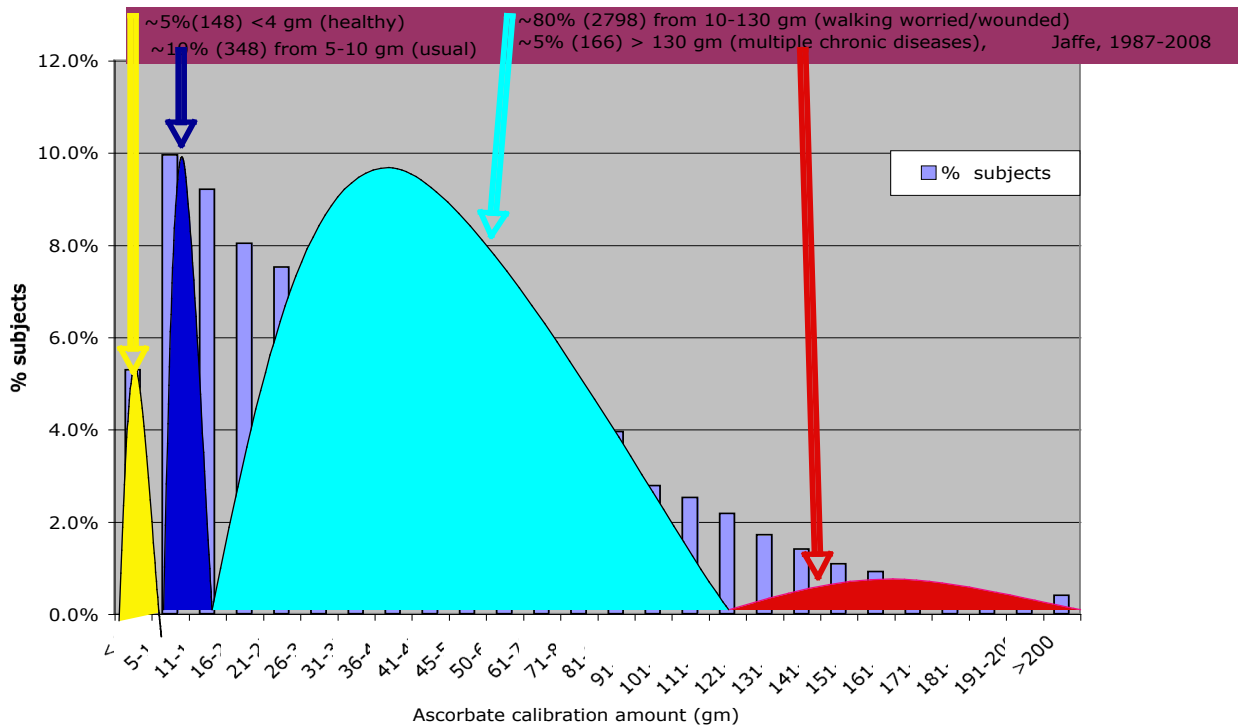


Figure 4: Effect on Mean Cortisol Values for Complete Group

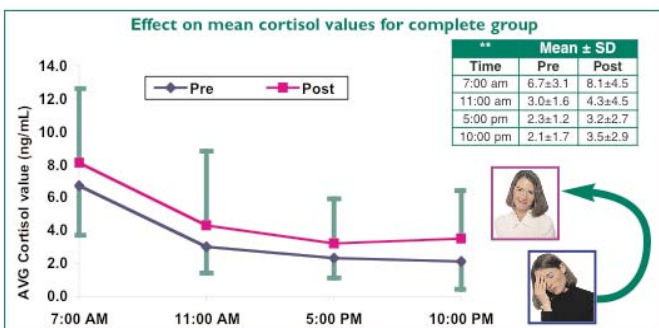
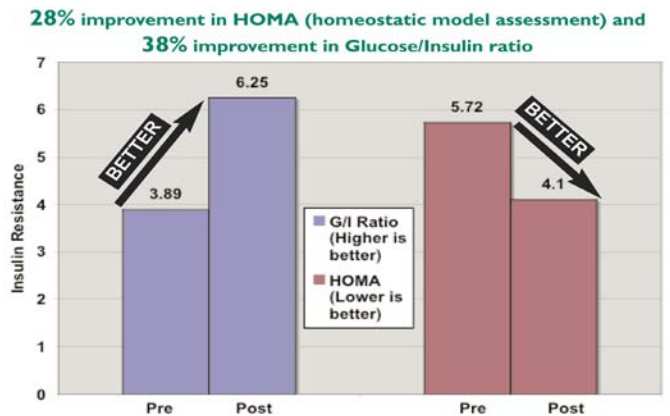


Figure 5: "DG": Improvement in Better Insulin Function with Improved HPA Axis





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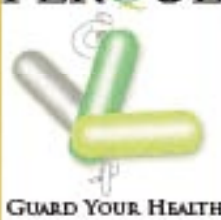
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