

Functional Vitamin, Mineral and Antioxidant Assessment

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Recent Publications

**“Antioxidant
supplementation
increases morbidity
and mortality.”**

JAMA, 2007

“Micronutrient testing offers a unique, scientifically based evaluation of functional deficiencies that allows targeted treatment with nutritional supplements... improving patient compliance with tailored therapy and success in the treatment of a variety of diseases.”

**Mark Houston, M.D.
Hypertension Institute
St Thomas Medical Center & Vanderbilt University**

**SCIENTIFIC
AMERICAN**

SEPTEMBER 1993
\$4.95

**SPECIAL
ISSUE**

**LIFE, DEATH AND
THE IMMUNE SYSTEM**

TOLERATING GRAFTS

FIGHTING CANCER

AIDS

ALLERGY

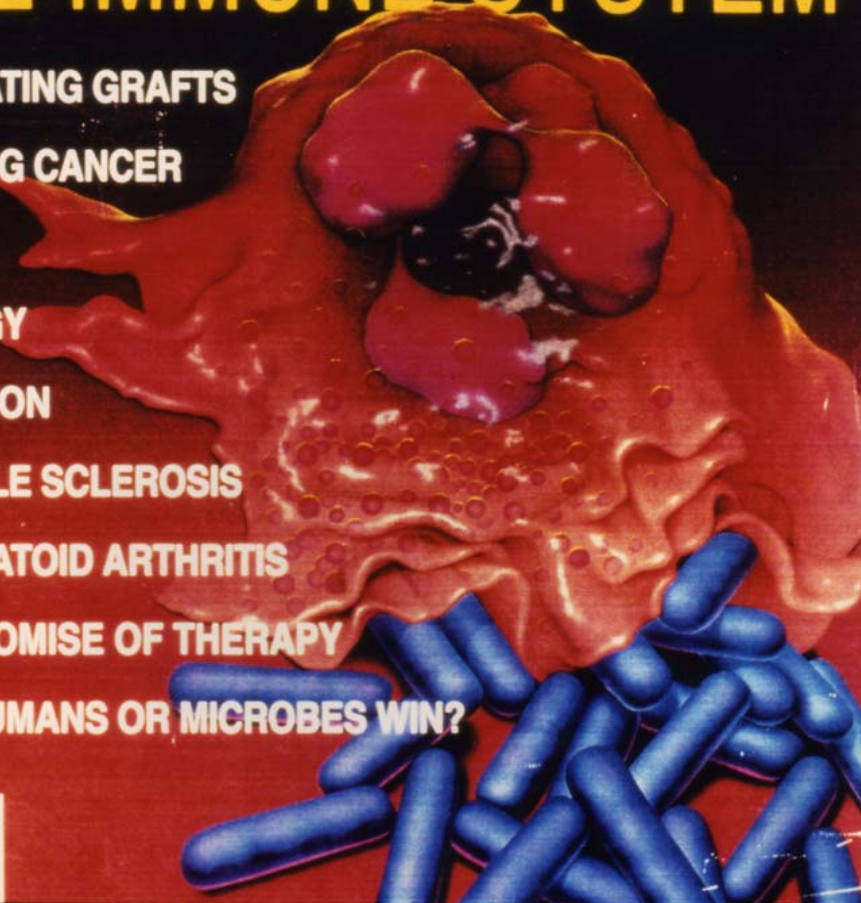
INFECTION

MULTIPLE SCLEROSIS

RHEUMATOID ARTHRITIS

THE PROMISE OF THERAPY

WILL HUMANS OR MICROBES WIN?



IMMUNOCOMPETENCE

CELL-MEDIATED IMMUNITY (Th1)
T-LYMPHOCYTES

HUMORAL IMMUNITY (Th2)
B-LYMPHOCYTES

T-LYMPHOCYTES

Th1 – (Cell Mediated Immunity)

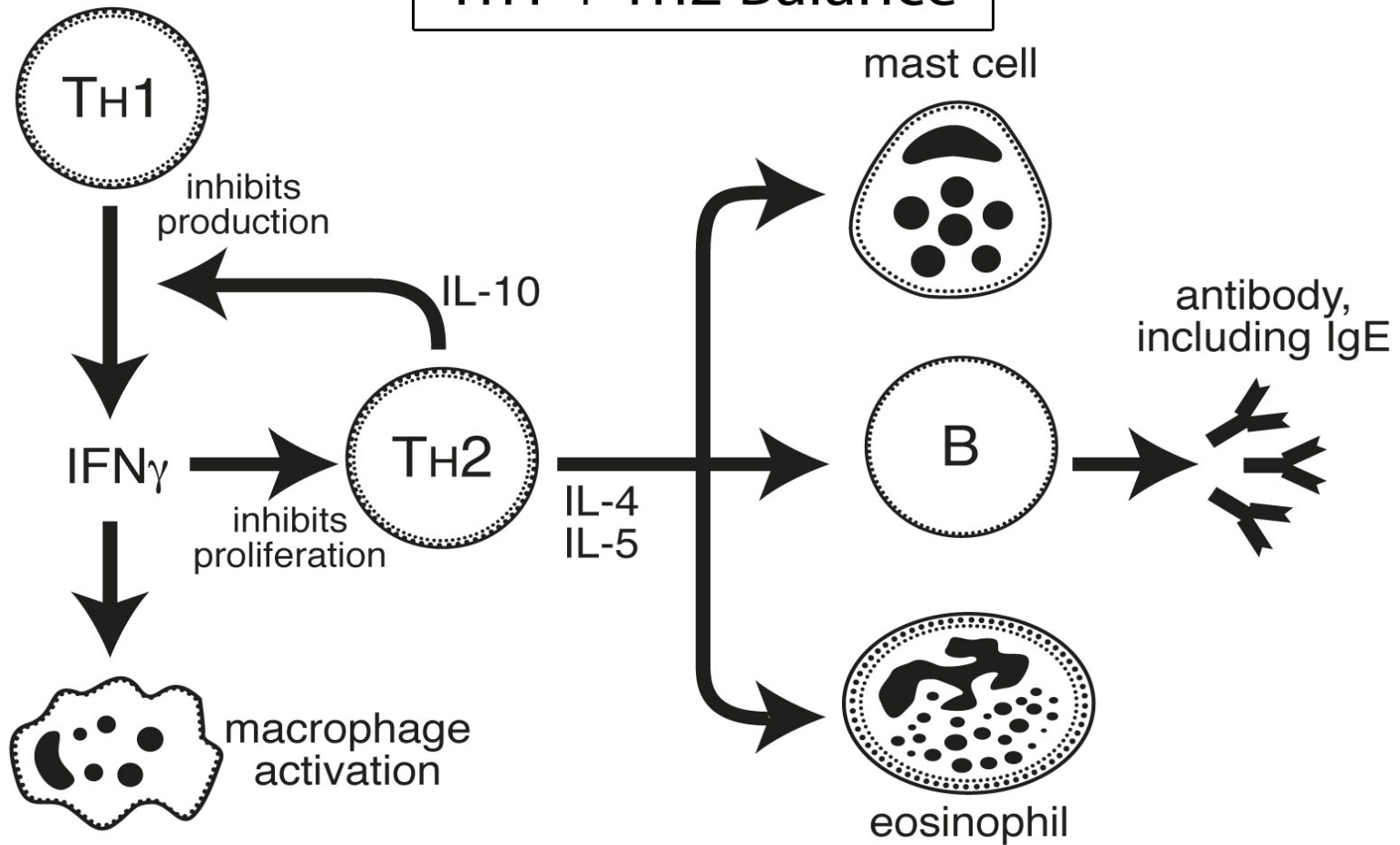
- Attack Intracellular Pathogens
 - DTH skin responses to viral + bacteria Ag
 - CANCER cells
- Organ Specific Autoimmune Disease
(Arthritis, MS, Type I Diabetes)

B-LYMPHOCYTES

Th2 (Humoral Immunity)

- Protection Against Extra Cellular Pathogens
- Antibody Production
- Allergy + Related I_gE – based disease
(Systemic Autoimmune Disease)

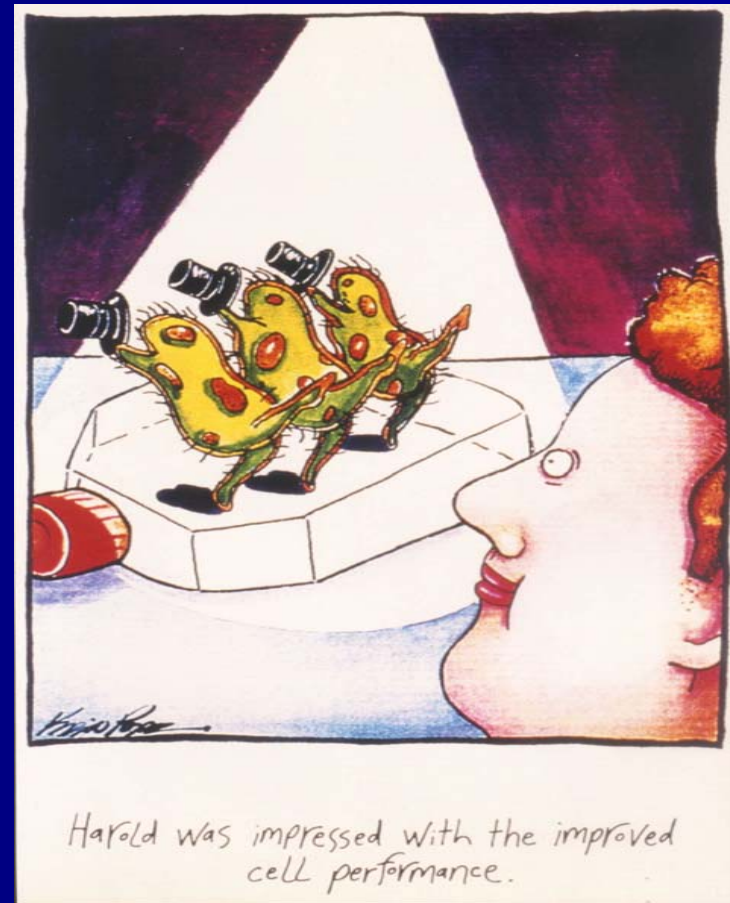
Th1 + Th2 Balance



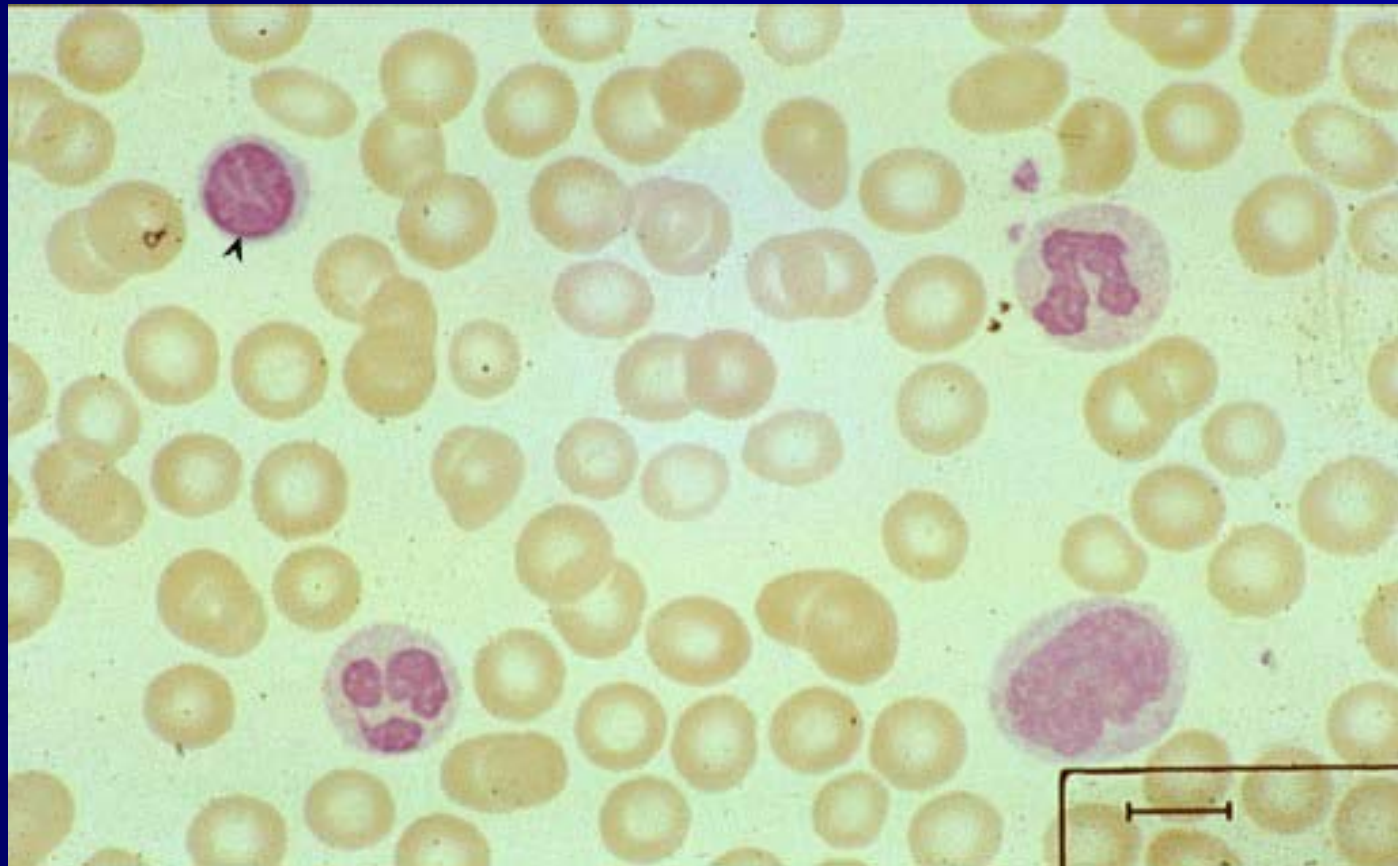
Adapted from: Roitt I, Brostoff J, Male D. *Immunology (Fifth Edition)*. Philadelphia: Mosby; 1998.

Improved Cellular Performance

Your cellular performance may also be improved after information obtained from micronutrient testing.



T-Lymphocytes are used for MNT



Technology Summary

Day 1	Isolation of Lymphocytes	Long term nutritional marker
Days 2-3	Incubation & Growth in defined culture media	Patented technology 15 yrs development at U.T. Austin
	Mitogen stimulation & growth	Vary components growth dependent on intracellular levels
Day 4	^3H Thymidine incorporation	200 growth measurements
Day 5	Growth response measurement	Deficiency, transport & metabolic requirements

Intracellular Micronutrient Testing

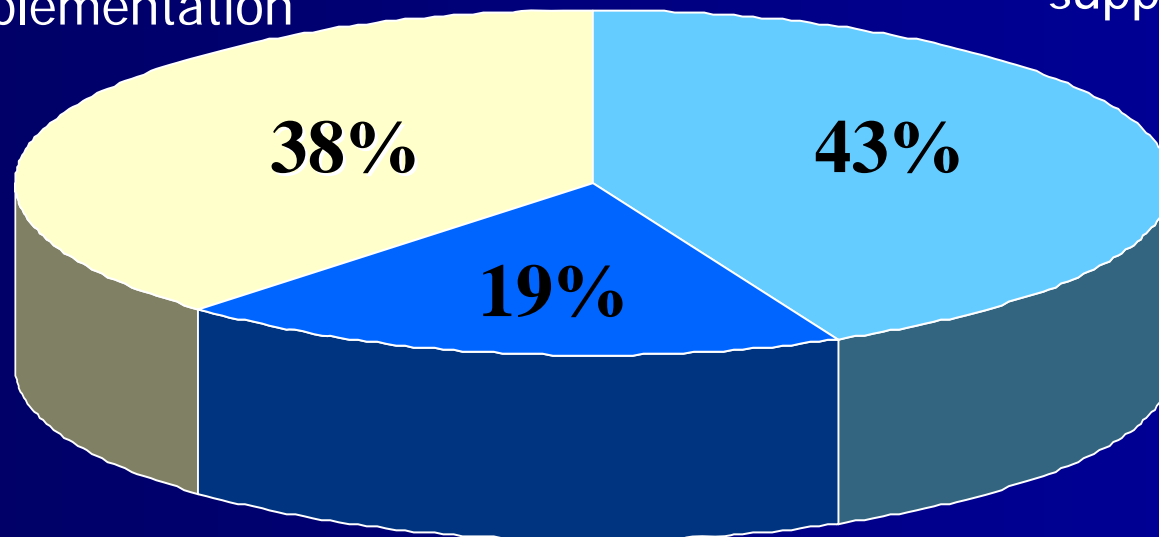
Nutrients Analyzed

Thiamin (B1)	Calcium	Fructose utilization
Riboflavin (B2)	Magnesium	SpectroX antioxidant function
Niacin (B3)	Zinc	Glutathione
Pantothenate (B5)	Serine	Cysteine
Pyridoxine (B6)	Glutamine	Selenium
Cobalamins (B12)	Asparagine	Vitamin C
Folate	Oleic Acid	Vitamin E
Biotin	Insulin Sensitivity	Vitamin D ⁽²⁾
Inositol	CoenzymeQ10	Vitamin K
Choline	Lipoic Acid	Carnitine
Chromium		Copper

Nutrient Deficiencies and Previous Supplementation

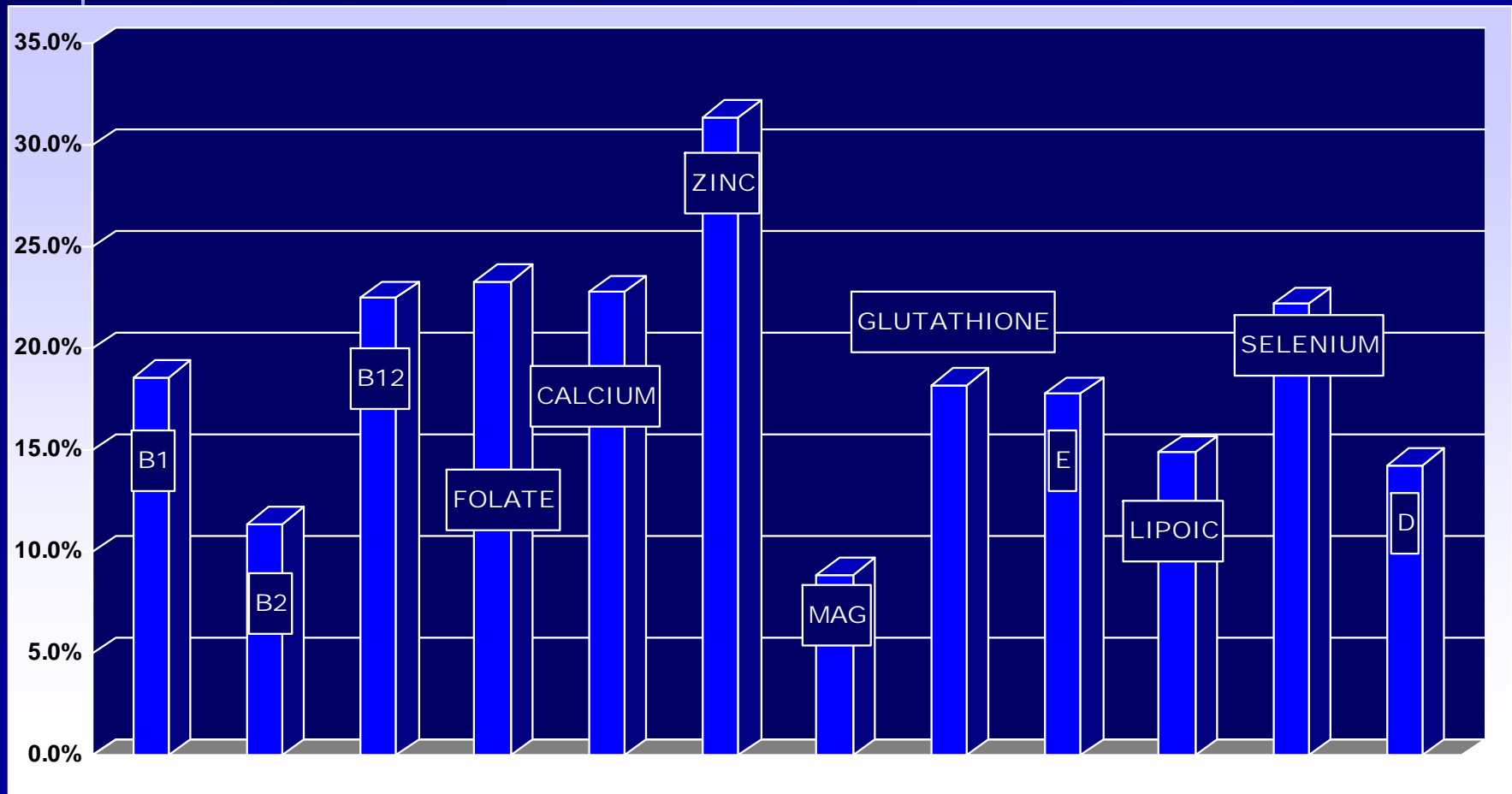
Multiple deficiencies
with no previous
supplementation

Multiple deficiencies
with previous
supplementation



Subjects showing
no deficiency

Intracellular Micronutrient Deficiencies



Factors Affecting Nutrient Status

Dietary Intake

Absorption

Transport

Storage

Receptors

Activation

Inhibition

Metabolism

Excretion

Hormonal Status

Genetic Influences

Disease

Lifestyle Factors

Pharmaceuticals

Age

Gender

Socioeconomic

Cultural/Ethnic

Pregnancy

Exercise

Smoking

Alcohol

**“High-dose Vitamin Therapy
Stimulates Variant Enzymes
with Decreased Coenzyme
Binding Affinity: Relevance to
Genetic Diseases and
Polymorphisms”**

*Bruce N. Ames, M.D., et al.,
The American Journal of Clinical Nutrition,
Vol 75, No 4, April 2002.*

Medications & Nutrient Deficiency

Anti-Depressants

Elavil, Tofranil, Sinequan, Aventyl

B12, CoQ10

Anti-Inflammatory

Aspirin, Advil, Motrin

Vit C, Folate

Prednisone, Cortisone

D, Folic, Cal, Mag, Selenium, Zinc

Statins

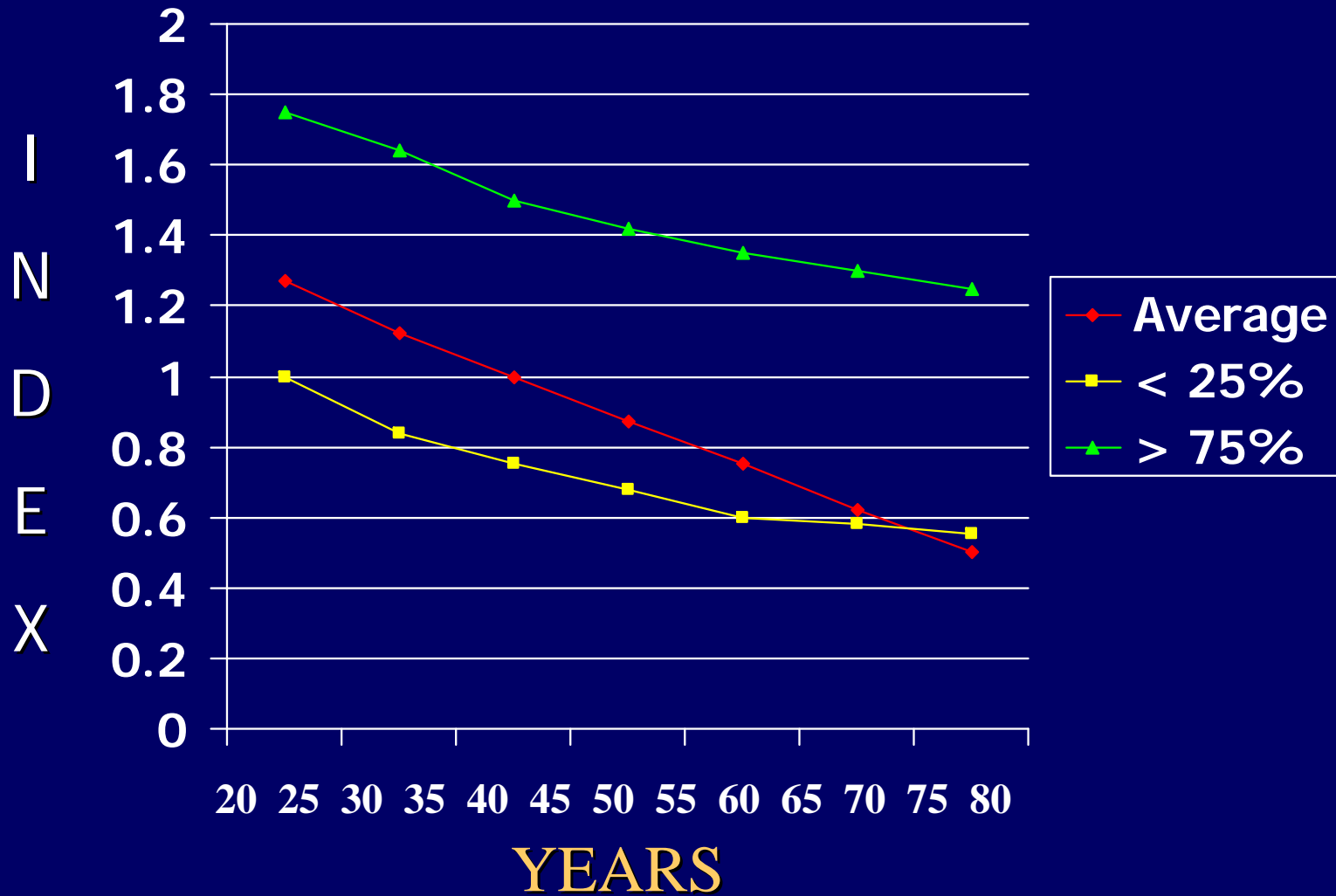
CoQ10, B12, D, E, Folic, A

Hormone Replacement Therapy

Evista, Premarin, Estratab

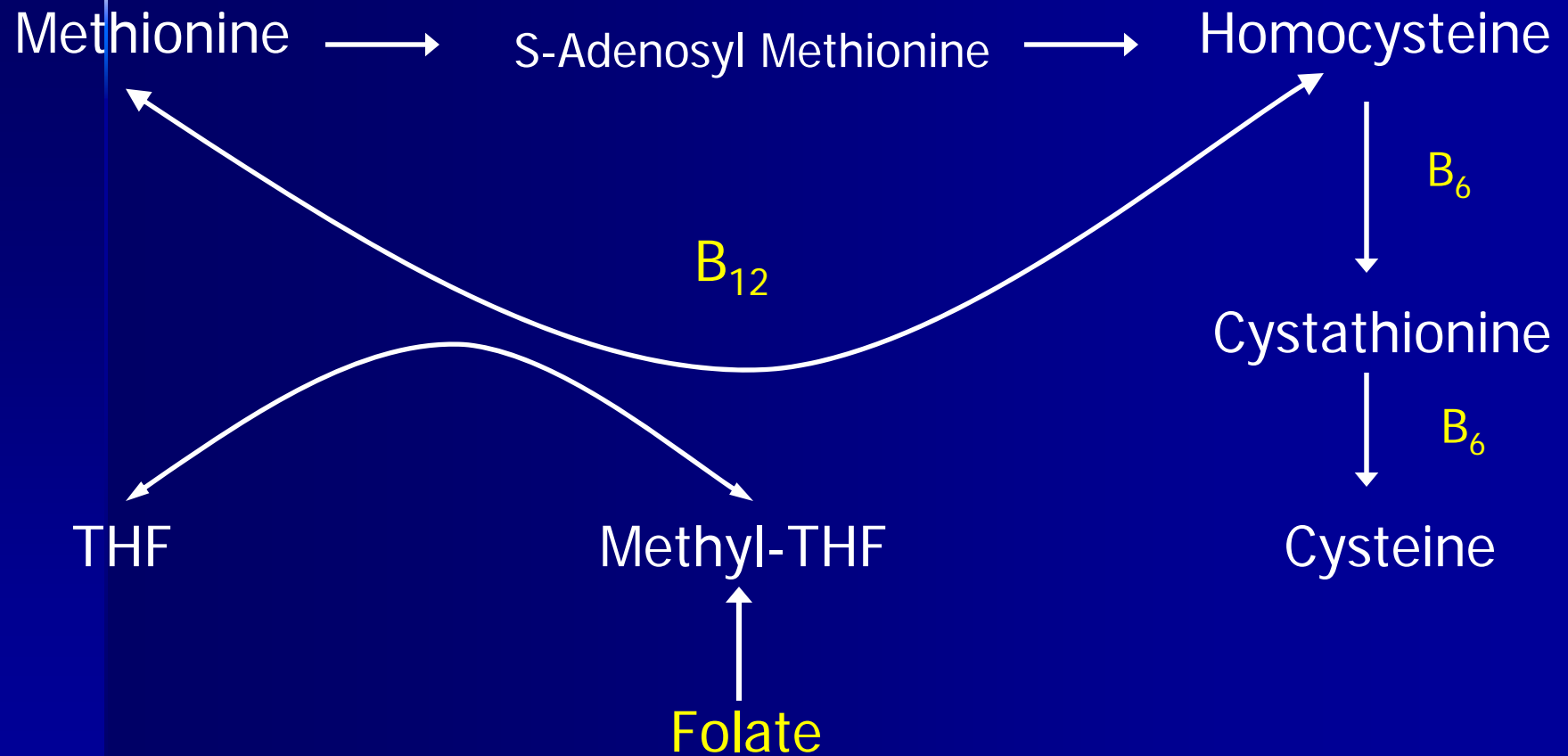
B2, B6, B12, C, Folate, Mag, Zinc

Proliferation Index



0 10 20 30 40 50 60 70 80 90 100

Biochemical Pathways



Homocysteine & Vascular Disease

Genetic and Dietary Determinants of Serum Homocysteine Concentrations

Genetic

- Cystathionine-beta-synthase deficiency
- Methionine synthase deficiency
- MTHFR deficiency
- Defective absorption of B₁₂ or Folate
- Prevalence:
 - 30% Female
 - 25% Male

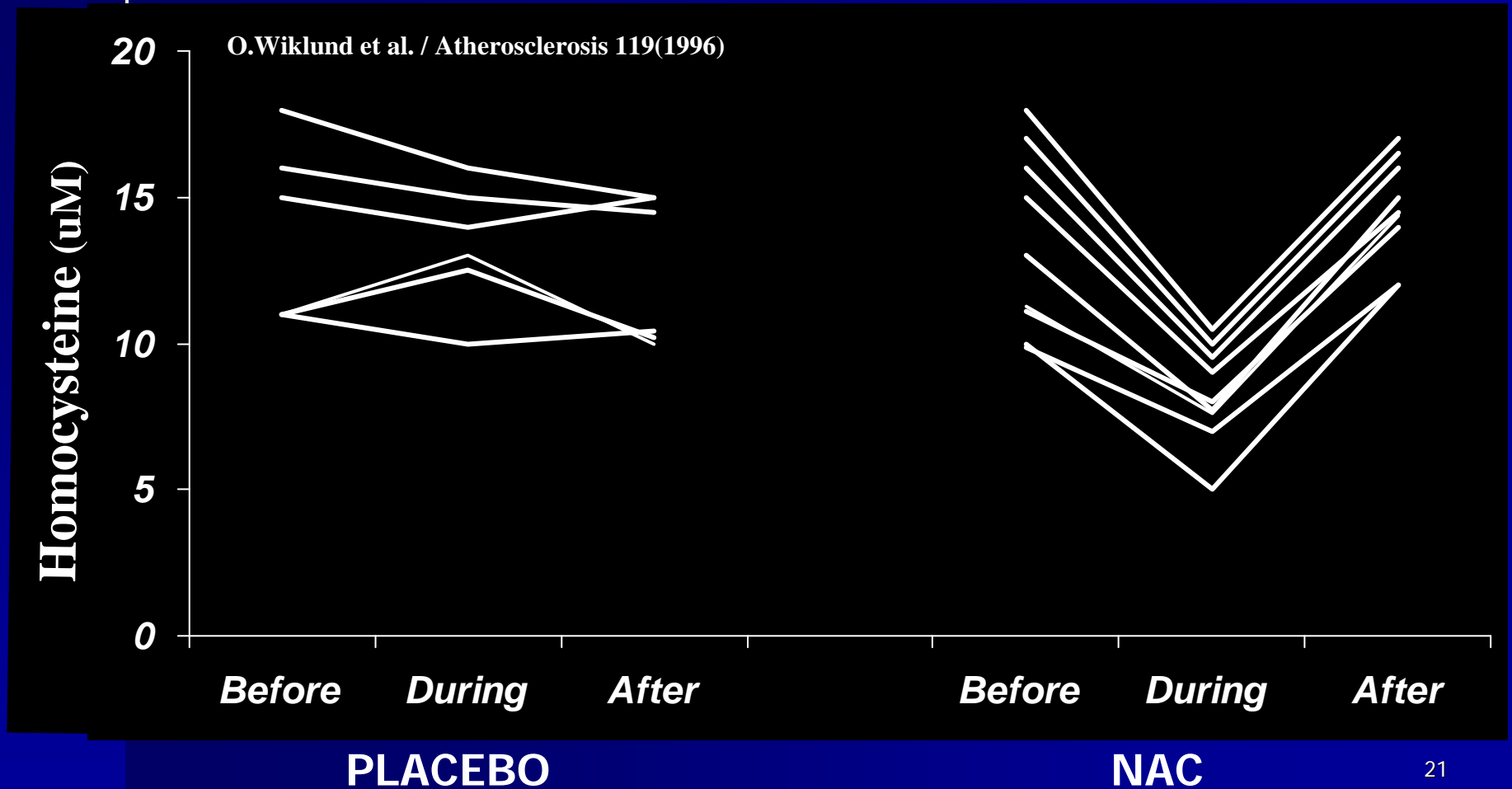
Nutritional *

- Vitamin B₆
- Vitamin B₁₂
- Folate

* 75% of cases of Hyperhomocysteinemia are nutritional in origin

Homocysteine & Vascular Disease

Effects of Treatment With N-Acetyl Cysteine (NAC)

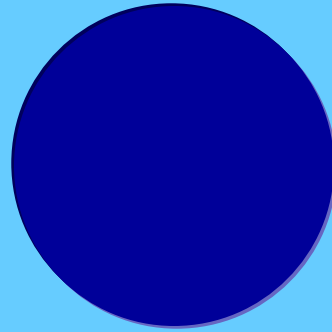


Model of Inflammation and Inflammatory Disease

Classical Inflammatory Mediators

- Cellular attack (free O₂)
- Macrophage releases lymphokines producing IL-1
- T-lymphocytes produce IL-2
- I-1 and I-2 proliferation of T-lymphocytes produce interferon
- Cell-killing activity of T-cells and NKC enhanced and free radical production

The Magic Bullet



Major Cellular Antioxidants

■ Antioxidant Nutrients

- Vitamin C (Ascorbate)
- Vitamin E (Tocopherols)
- Selenium
- Glutathione

■ Antioxidant Enzymes

- Superoxide Dismutase (Zn Cu, Mn)
- Catalase (Fe)
- Glutathione Peroxidase (Se)

Markers of Oxidative Stress

Thiobarbituric Acid Reactive Substances (Tbars)

Lipid Peroxides

Isoprostanes

Guanosine Derivatives

Selenium

Protein Carbonyls

Orac & Trap

Lymphocyte Culture (Spectrox)

Antioxidant Balance

Prostaglandins (E series)
thromboxanes, leukotrienes

Arachadonic acid peroxy radical

12-HETE (alcohol)

12-HPETE (hydroperoxide
endoperoxide)

✂ tocopherol

✂ tocopherol radical ox

Dehydroascorbate

Ascorbate

Glutathione (GSH)

Glutathione disulfide (G-S-S-G)

NADP

NADPH

Spectrox - Total Antioxidant Function

Status

Result: 51.2 Percentile

Reference Range:

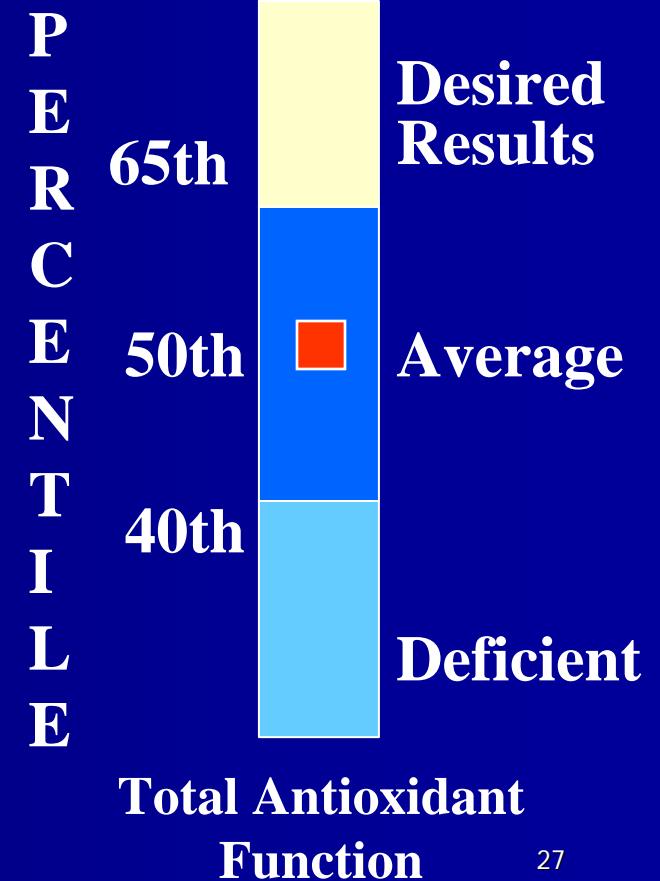
Desired > 65th percentile

Average 40th to 65th percentile

Deficient < 40th percentile

■ Desired ■ Average/Deficient

SPECTROX



Antioxidant Testing

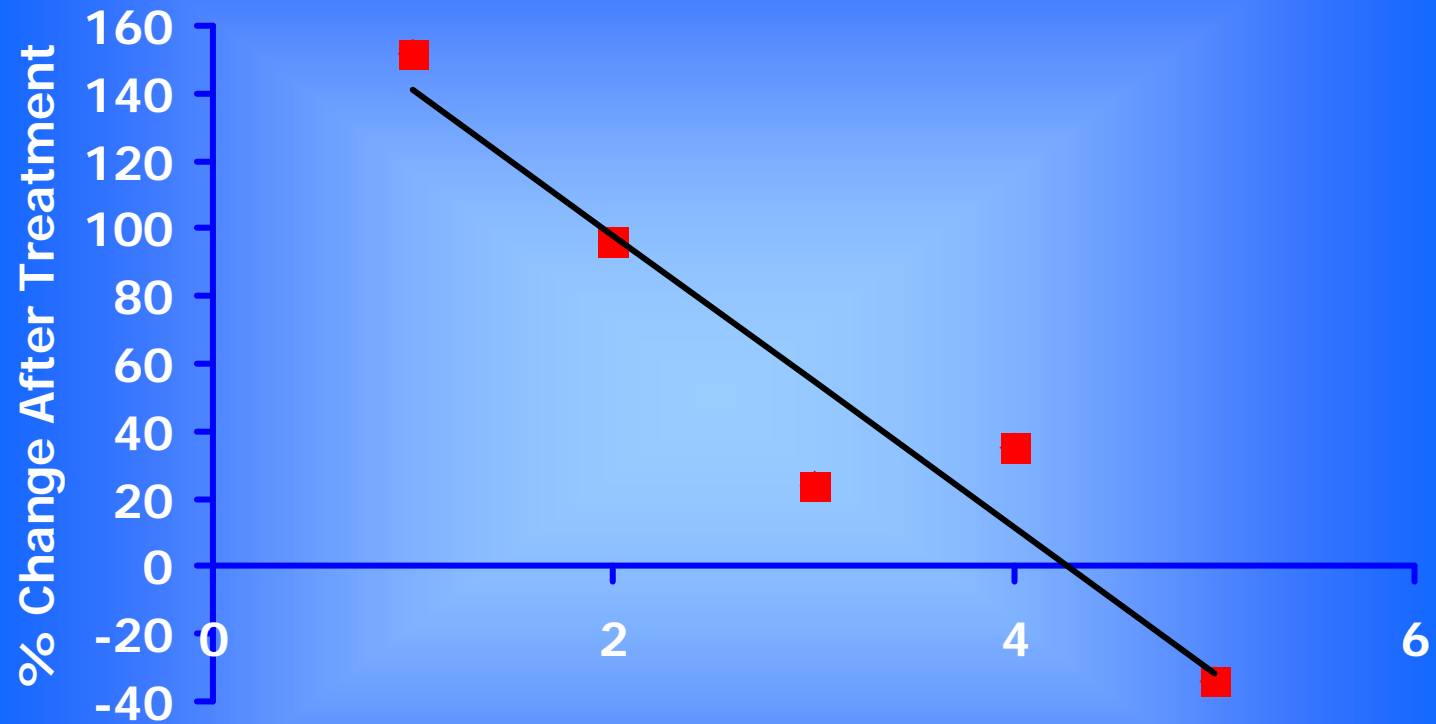
100% Complete + Cells + Free Radicals = Spectrox 1

100% Complete + Cells + Selenium = Saturated Cells

Saturated Cells + Free Radicals = Spectrox 2

Measurement: % improvement in Spectrox 1

Figure 1



**Pre-Treatment Spectrox Value Range:
1<25, 2= 25-40, 3=40-55, 4=55-70, 5>75
($p<0.05$)**

TSH

↓ Iodine ——— ↓

↓ Ferritin ———

Vit D₃ ———

Zinc

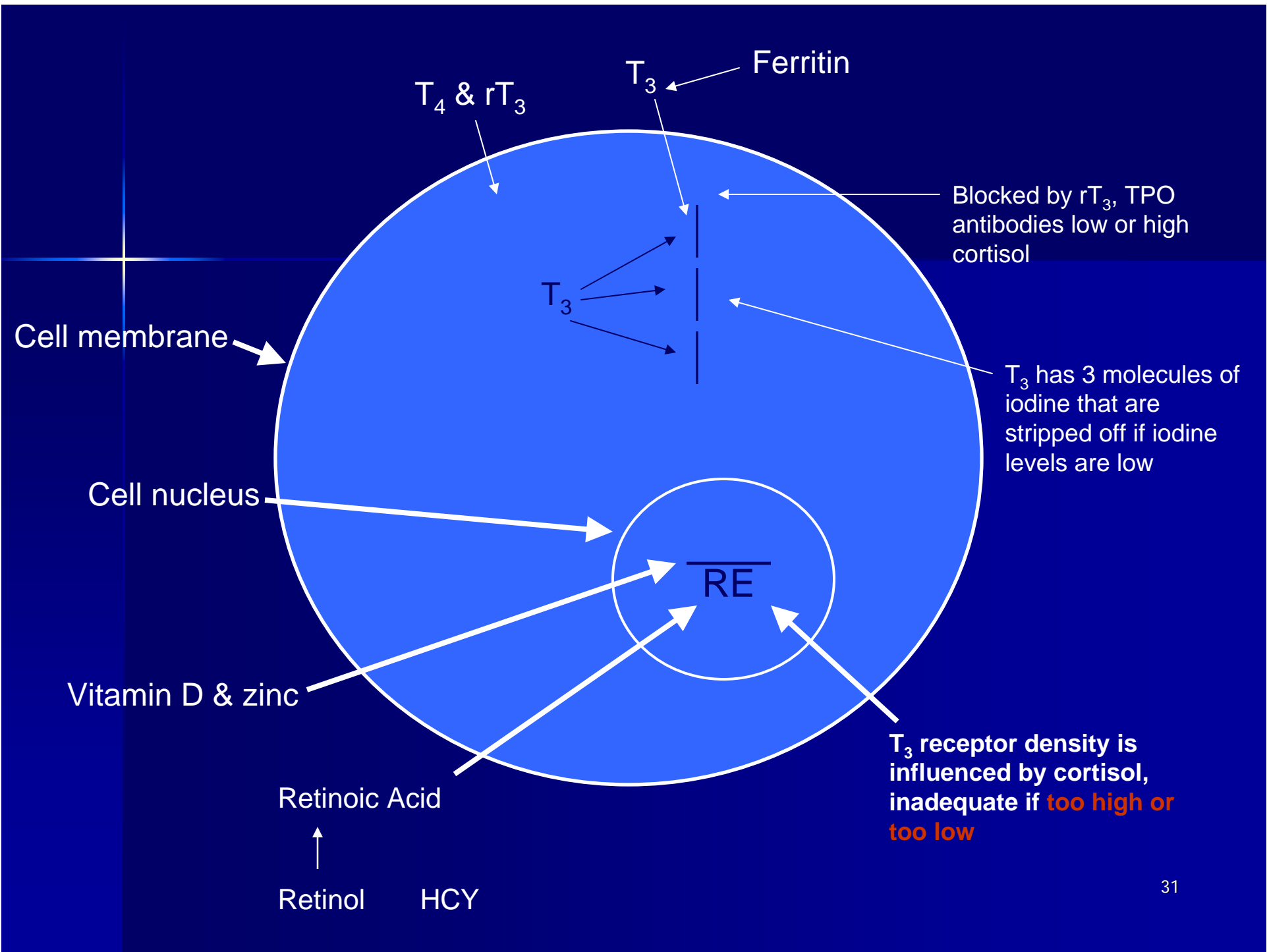
T₄ to T₃ decreased by
rT₃, deficiencies of
selenium, zinc,
chromium, etc.

T₄ to T₃ increased by
abnormal cortisol, TPO
antibodies, T₄
medication (Synthroid),
estrogen

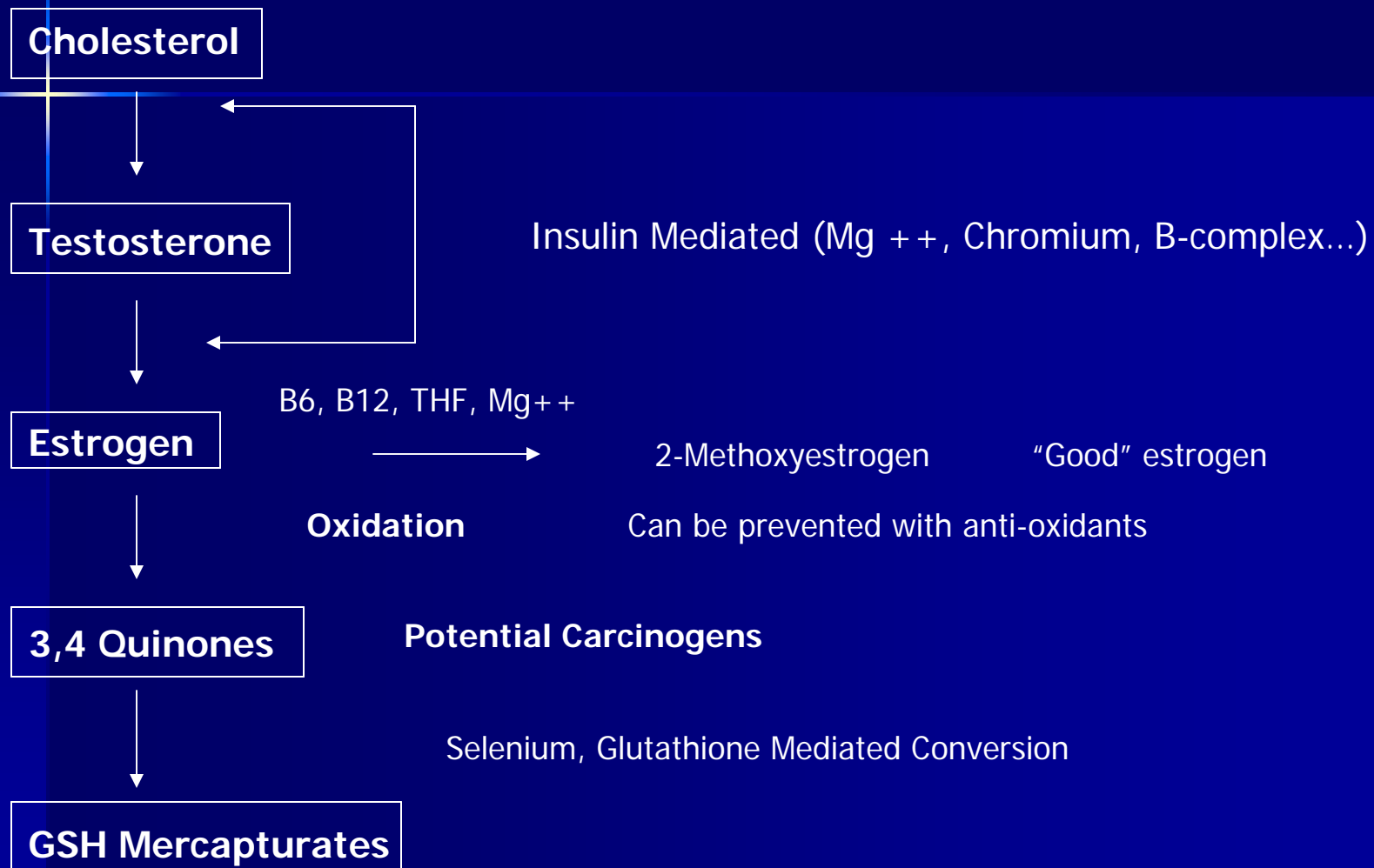
T₄

(Good) T3

rT3 (Bad) (Excess)



Nutrition and Estrogen Metabolism



Essential Hypertension

Diagnosis + treatment of intracellular nutrient deficiencies, oxidative stress, + insulin resistance will:

- Reduce Blood Pressure
- Improve Vascular Health
- Improve Endothelial Function

Mark Houston, MD, In Press, Therapeutic Advances in Cardiovascular Disease (2010)

Percentage Deficiency in Hypertensive & Control Populations

	Hypertension	Control	P
Serine	10.9%	6.3%	0.0001
Insulin	18.9%	14.1%	0.0136
Calcium	21.6%	14.8%	0.0007
Vitamin D	32.2%	21.6%	0.0294
CoQ10	16.9%	9.1%	0.0294

Mark Houston, MD, In Press, Therapeutic Advances in Cardiovascular Disease (2010)

Essential Hypertension

“Replacement of the micronutrient deficiencies, as well as high dose therapy of selected nutraceuticals in combination with optimal diet, exercise and weight management resulted in control of blood pressure to goal levels in 62% of the hypertensive population over a period of 6 months with complete tapering and discontinuation of anti-hypertensive drugs”.

Mark Houston, MD, In Press, Therapeutic Advances in Cardiovascular Disease (2010)

Coenzyme Q10 Deficiency in Patients on Statin Therapy

Without Q10 Supplementation

Serum	4/15	26.6%
FIA	47/92	51.1%

With Q10 Supplementation

Serum	2/15	13.3%
FIA	28/90	31.1%

LABORATORY REPORT

Account Number: 123456

Dr. John Smith
123 Main St
Anytown, USA

Name: Jane Doe
Gender: Female

DOB: 11/13/1947

Accession Number:
Requisition Number:

J71101
781864

Date of Collection:
Date Received:
Date Reported:

05/19/2010
05/20/2010
06/01/2010

Summary of Deficient Test Results

Testing determined the following functional deficiencies:

Vitamin D3
Spectrox

Calcium

Zinc

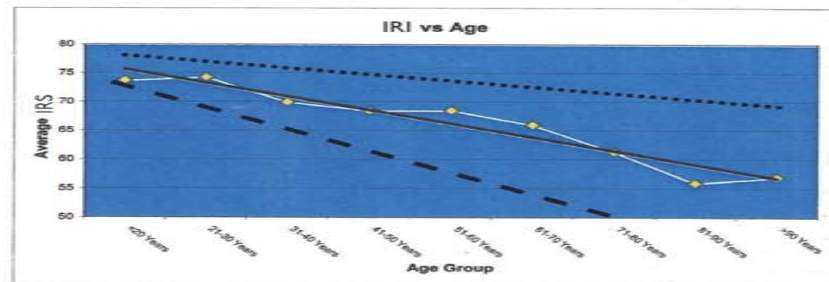
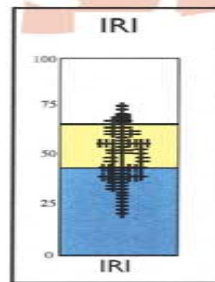
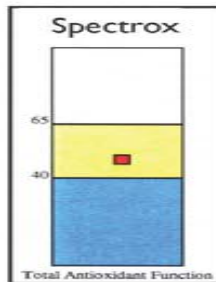
Glutathione

Borderline deficiencies include:

Vitamin B2

Panthenic Acid

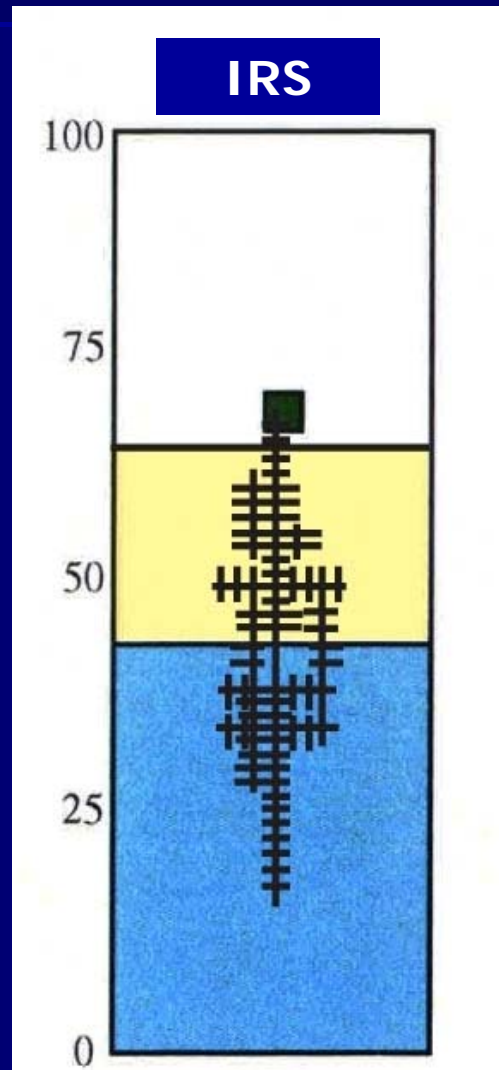
The Immune Response Index is an indication of the patient's T-lymphoproliferative response to mitogen stimulation relative to the response of a control population. A result greater than 65% indicates a healthy response, a measurement of cell-mediated immune function. A result between 40% and 64% indicates an average response that may improve with correction of the nutritional deficiencies determined by the micronutrient testing. Test results below 40% indicate a poor immune response and for better immune function requires improvement.



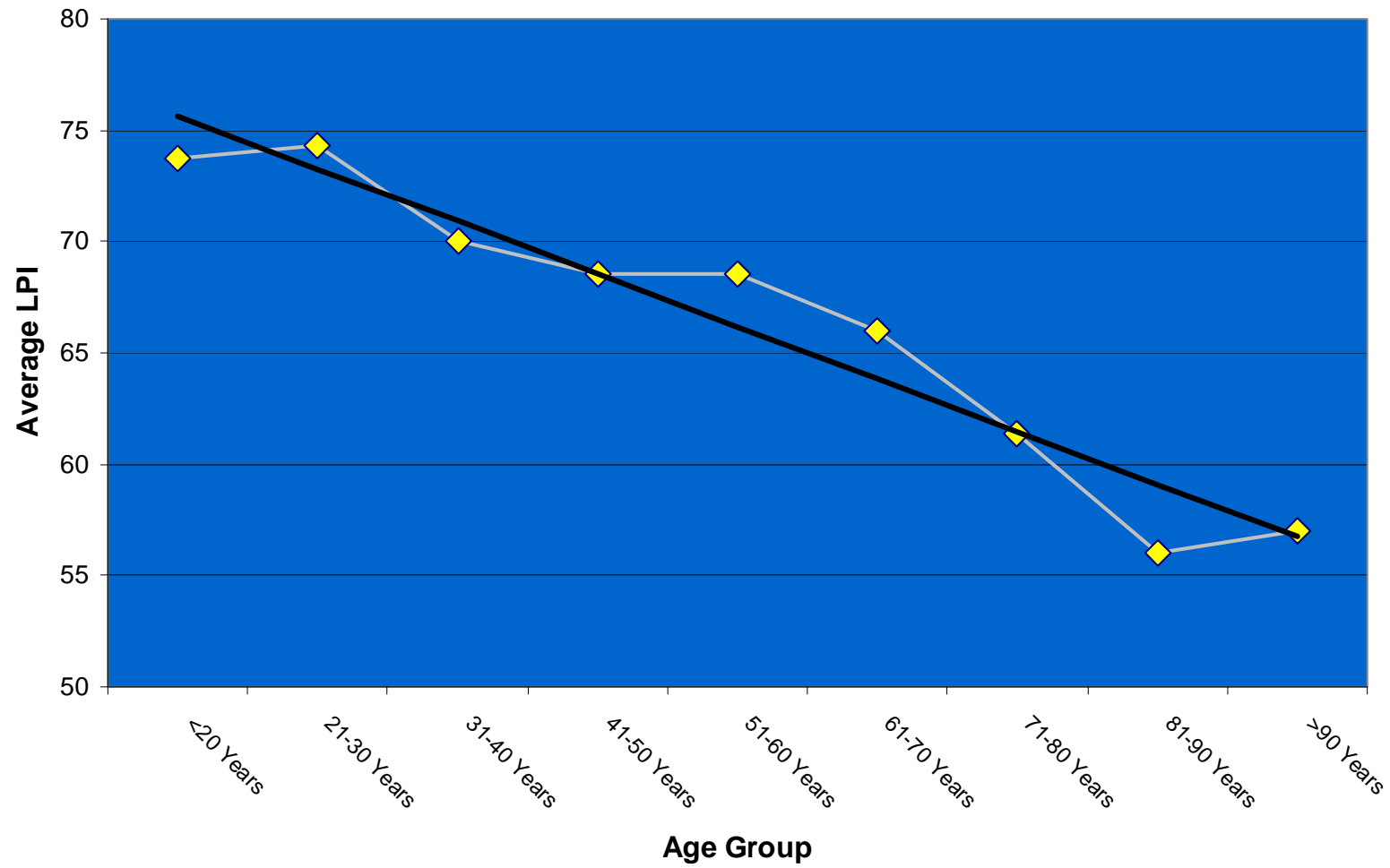
John F. Crawford, Ph.D.
Laboratory Director

CLIA# 45D0710715

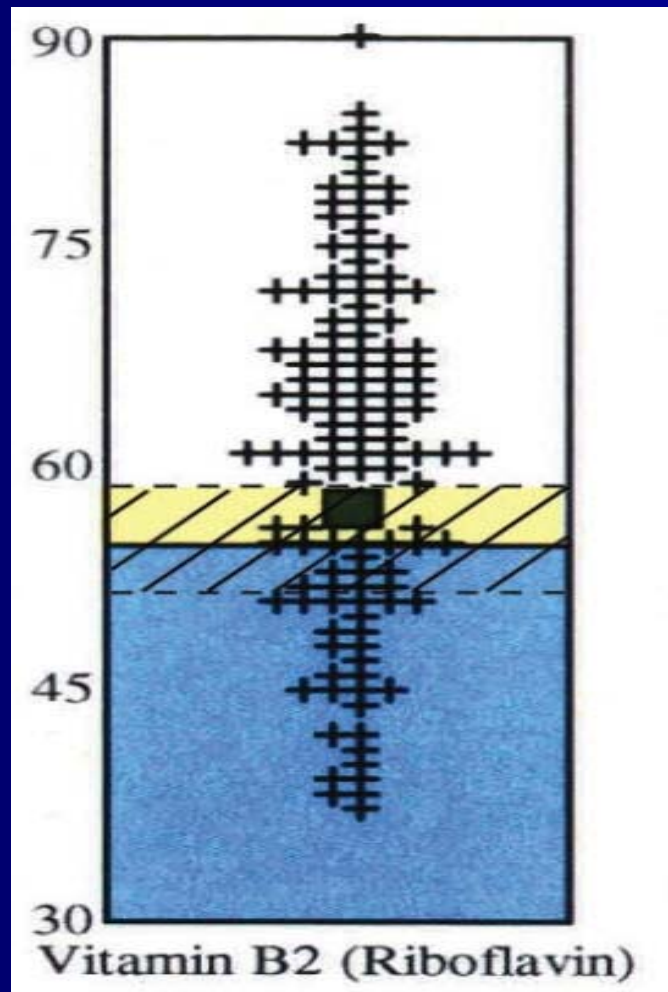
Immune Response Score (Th₁)



IRS vs Age



Borderline Deficiencies



Repletion Suggestions

- | | |
|---------------------------------|--|
| 1. Vitamin D3 (Cholecalciferol) | 1000 IU b.i.d.(2000 IU daily) of Cholecalciferol (Vitamin D3-1-alpha 25-dihydroxyvitamin D) |
| 2. Calcium | 500 mg b.i.d. (1000 mg daily) as citrate, malate, ascorbate or glycinate |
| 3. Zinc | 25 mg daily |
| 4. Total Antioxidant Function | Based on Spectrox and individual Antioxidant tests:

* Glutathione Deficient: 600 mg t.i.d. (1800 mg daily) of N-Acetylcysteine (NAC) Take each dose with a meal

* Cysteine: The daily dose of N-Acetylcysteine (NAC) listed for Glutathione is usually sufficient for Glutathione and/or Cysteine repletion.

* Vitamin E: 200 IU daily of mixed tocopherols

* Selenium: 50 mcg daily

* Coenzyme Q10: 30 mg daily of CoQ10 Take each dose with a meal

* Lipoic Acid: 50 mg daily

* Vitamin C: 250 mg daily |

Please note: Supplementation is usually required for four to six months to effect the repletion of a functional deficiency in lymphocytes

Suggestions for supplementation with specific micronutrients must be evaluated and approved by the attending physician. This decision should be based upon the clinical condition of the patient and the evaluation of the effects of supplementation on current treatment and medication of the patient.

The Modifiable Risk Factors for Optimal Aging

- Strengthen Immune Function
- Optimize Methylation Metabolism
- Limit Inflammatory Processes
- Improve Mitochondrial Function
- Reduce Chronic Stress
- Regulation of Glycemic / Insulin Function



THE BALANCE