Nutritional Triage

James Doherty

“It’s all about living for today. Nature favors survival today over tomorrow, Nutrient Triage Theory “makes sense...and will certainly prove correct” World-renowned scientist - Dr. Bruce Ames.
“Men grow gardens...”

– Allen Flanagan
<table>
<thead>
<tr>
<th>Supplement Facts</th>
<th>Amount Per Serving</th>
<th>% Daily Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving Size: 1 Capsule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servings per Container: 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A (as beta carotene and retinyl palmitate)</td>
<td>10000 IU</td>
<td>200%</td>
</tr>
<tr>
<td>Vitamin C (as ascorbic acid)</td>
<td>150 mg</td>
<td>250%</td>
</tr>
<tr>
<td>Vitamin D (as cholecalciferol)</td>
<td>400 IU</td>
<td>100%</td>
</tr>
<tr>
<td>Vitamin E (as d-alpha tocopheryl acid succinate)</td>
<td>100 IU</td>
<td>333%</td>
</tr>
<tr>
<td>Thiamin (as thiamin mononitrate)</td>
<td>25 mg</td>
<td>1,667%</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>25 mg</td>
<td>1,471%</td>
</tr>
<tr>
<td>Niacin (as niacinamide)</td>
<td>100 mg</td>
<td>500%</td>
</tr>
<tr>
<td>Vitamin B6 (as pyridoxine hydrochloride)</td>
<td>25 mg</td>
<td>1,250%</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>800 mcg</td>
<td>200%</td>
</tr>
<tr>
<td>Vitamin B12 (as cyanocobalamin)</td>
<td>100 mcg</td>
<td>1,667%</td>
</tr>
<tr>
<td>Biotin</td>
<td>300 mcg</td>
<td>100%</td>
</tr>
<tr>
<td>Pantothenic Acid (as d-calcium pantothenate)</td>
<td>50 mg</td>
<td>500%</td>
</tr>
<tr>
<td>Calcium (as calcium carbonate and calcium citrate)</td>
<td>25 mg</td>
<td>3%</td>
</tr>
<tr>
<td>Iodine (as potassium iodide)</td>
<td>150 mcg</td>
<td>100%</td>
</tr>
<tr>
<td>Magnesium (as magnesium oxide and magnesium aspartate)</td>
<td>7.2 mg</td>
<td>2%</td>
</tr>
<tr>
<td>Zinc (as zinc picolinate)</td>
<td>15 mg</td>
<td>100%</td>
</tr>
<tr>
<td>Selenium (as sodium selenate)</td>
<td>200 mcg</td>
<td>286%</td>
</tr>
<tr>
<td>Copper (as copper gluconate)</td>
<td>2 mg</td>
<td>100%</td>
</tr>
<tr>
<td>Manganese (as manganese gluconate)</td>
<td>5 mg</td>
<td>250%</td>
</tr>
<tr>
<td>Chromium (as chromium chloride)</td>
<td>200 mcg</td>
<td>167%</td>
</tr>
<tr>
<td>Molybdenum (as sodium molybdate)</td>
<td>150 mcg</td>
<td>200%</td>
</tr>
<tr>
<td>Choline (as choline bitartrate)</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Inositol</td>
<td>10 mg</td>
<td>*</td>
</tr>
<tr>
<td>FloraGLO® Lutein</td>
<td>500 mcg</td>
<td>*</td>
</tr>
</tbody>
</table>

* Daily value not established.

Other Ingredients: Gelatin, alginic acid, croscarmellose sodium, potassium citrate, soy lecithin, medium chain triglycerides, magnesium silicate, vegetable stearic acid, silica, magnesium stearate, potassium aspartate.
Birke Baehr: What's wrong with our food sy:
Declining Fruit and Vegetable Nutrient Composition: What Is the Evidence?

Donald R. Davis

Biochemical Institute, The University of Texas, Austin, TX 78712; and Bio-Communications Research Institute, 3100 Nor.

Additional Index Words: nutritive value • history • dilution effect • genetic dilution effect • agriculture • grains

Three kinds of evidence point toward declines of some nutrients in fruits and vegetables available in the United States and th fertilization found inverse relationships between crop yield and mineral concentrations—the widely cited "dilution effect"; 2 composition data found apparent median declines of 5% to 40% or more in some minerals in groups of vegetables and perha and protein with similar results; and 3) recent side-by-side plantings of low- and high-yield cultivars of broccoli and grains between yield and concentrations of minerals and protein, a newly recognized genetic dilution effect. Studies of historical fo but the other methods can focus on single crops of any kind, can include any nutrient of interest, and can be carefully controlled to minimize or overcome the diluting effects of yield whether by environmental means or by plant breeding.
Hey farmer, farmer, put away that DDT...

Give me spots on my apples,

But LEAVE me the birds and the bees, please!
Discover Blue Zones®

Employing a vast amount of data, Blue Zones® researchers and scientists have identified places around the world where people live longer and know how to be happier than the rest of us.

The Islands of Okinawa, Japan

While Okinawans do suffer from diseases that kill Americans, they experience them at far lower rates: a fifth the rate of cardiovascular disease, a fourth the rate of breast and prostate cancer, and one-third the rate of dementia.

Sardinia, Italy

In summer 2011, researchers confirmed the mountainous village of Villagrande Strisalli as having the highest concentration of male centenarians in the world. Perhaps the most important longevity secret is found in the outlook of its people. Their caustic sense of humor helps them shed stress, and their devotion to family provides invaluable support.

Loma Linda, California

For the past half-century, members of the Seventh Day Adventist community in Loma Linda, whose faith endorses healthy living, leads the nation in the longest life expectancy. They are vegetarians. They eat frequent servings of nuts. They eschew alcohol. They eat an early, light dinner, and focus on the Sabbath every week when they devote time to their faith and family.
100 yr/old - Centenarian George Burns (January 20, 1896 – March 9, 1996)
Nutritional Aging Theories

1. Genetic potential –
2. Free radicals (antioxidants)
3. Cross-linked proteins
4. Chronic inflammation
5. Endocrinology & immunity

All are interrelated – none are complete without the most important aging theory discovered to date
Dr. Bruce Ames – Research focused on aging, mitochondria and malnutrition

He has been published in over 500 scientific journals, and gained long lists of honors and awards

Considered the most important anti-aging theory ever proposed

“the most important thing I have ever worked on”
Nutrient Triage Theory

“It’s all about living for today. Nature favors survival today over tomorrow, Nutrient Triage Theory “makes sense…and will certainly prove correct” says world-renowned scientist Dr. Bruce Ames.

Professor Bruce Ames ‘triage theory’ makes sense and gains support

Why modest shortages of vitamins / minerals matter so much

by the ANH team

Dr Bruce Ames is Professor of Biochemistry and Molecular Biology, University of California, Berkeley, and a Senior Scientist at Children's Hospital Oakland Research Institute (CHORI). His Curriculum Vitae reminds us of the importance of Dr Ames’ scientific experience and contributions, having published over 500 scientific journals, and gained long lists of honours and awards.

Triage theory: short-term survival at the expense of long-term survival

In 2006, Professor Ames published a key article in the Proceedings of the National Academy of Sciences of the United States of America (PNAS), entitled ‘Low micronutrient...
# Body’s Mechanism for Handling Low Micronutrient Status

<table>
<thead>
<tr>
<th>Vitamin C</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collagen (scurvy)</td>
<td>Survival</td>
<td></td>
</tr>
<tr>
<td>2. Neurotransmitters</td>
<td>Survival</td>
<td></td>
</tr>
<tr>
<td>3. Carnitine</td>
<td>Survival</td>
<td></td>
</tr>
<tr>
<td>4. Inflammation</td>
<td></td>
<td>Aging</td>
</tr>
<tr>
<td>5. Oxidative stress</td>
<td></td>
<td>Aging</td>
</tr>
</tbody>
</table>

Essentially the body cannibalizing itself

Smokers

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*American Journal of Clinical Nutrition (Vol. 90, pp. 889-907)*

*Proceedings of the National Academy of Sciences of the United States of America (PNAS), entitled ‘Low micronutrient intake may accelerate the degenerative diseases of aging through allocation of scarce micronutrients by triage’*
Fruit proves better than vitamin C alone

Tests show that it isn't just the vitamin that protects the body.

Matt Kaplan

If you're in the market for an antioxidant to keep your body young and healthy, new research suggests you'd be much better off with oranges than vitamin C tablets.
# Fruits Prove Better than Vitamin C

*Journal of Nature, University of Milan, Italy – April 2007*

<table>
<thead>
<tr>
<th></th>
<th>Blood Plasma Vitamin C Levels (3.5hrs later)</th>
<th>Protective Effect (w/hydrogen peroxide-induced DNA damage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood orange juice (150mgs)</td>
<td>Increase</td>
<td>Protective effect: damage significantly less</td>
</tr>
<tr>
<td>Vitamin C-fortified water (150mgs)</td>
<td>Increase</td>
<td>No protective effect</td>
</tr>
<tr>
<td>Sugar water</td>
<td>No Change</td>
<td>No protective effect</td>
</tr>
</tbody>
</table>
“It appears that vitamin C is not the only chemical responsible for antioxidant protection; there is something more at work here.”

– Researcher, Serena Guarnieri, *British Journal of Nutrition*
Brief Communications

Nature 405, 903-904 (22 June 2000) | doi:10.1038/35016151

Nutrition: Antioxidant activity of fresh apples

Marian V. Eberhardt1, Chang Yong Lee1 & Rui Hai Liu1

Vitamin C is used as a dietary supplement because of its antioxidant activity, although a high dose (500 mg) may act as a pro-oxidant in the body1,2. Here we show that 100 g of fresh apples has an antioxidant activity equivalent to 1,500 mg of vitamin C, and that whole-apple extracts inhibit the growth of colon- and liver- cancer cells in vitro in a dose-dependent manner. Our results indicate that natural antioxidants from fresh fruit could be more effective than a dietary supplement.

1. Department of Food Science, 108 Stocking Hall, Cornell University, Ithaca, New York 14853-7201, USA

Correspondence to: Rui Hai Liu1 e-mail: RL23@cornell.edu
The Evolution of Vitamin E

What’s Next?

New Tocopherols discovered

Tocotrienols

Mixed Tocopherols

D-Alpha

Brown Rice

Journal of Diabetes Care

- Vitamin E rich foods work
- Supplements don’t
δ-Tocomonoenol: A new vitamin E from kiwi (Actinidia chinensis) fruits

Antonio Fiorentino a,∗, Claudio Mastellone a, Brigida D’Abrosca a, Severina Pacifico a, Monica Scognamiglio a, Giuseppe Cefarelli a, Romualdo Caputo b, Pietro Monaco a

a Dipartimento di Scienze della Vita, Laboratorio di Fitochimica, Seconda Università degli Studi di Napoli, via Vivaldi 43, I-81100 Caserta, Italy
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Vitamin E
NMR analysis
GC–MS
Antioxidant activity

ABSTRACT

A new vitamin E, δ-tocomonoenol, has been isolated from Actinidia chinensis (kiwi) fruits. The new structure, 2,8-dimethyl-2-(4,8,12-trimethyltridec-11-enyl)chroman-6-ol, has been elucidated on the basis of EIMS, 1D, and 2D NMR spectral data. GC–MS analysis of peels and pulps of kiwi showed that the new compound, together with δ-tocopherol, is mainly present in the fruit peel, whilst α-tocopherol is present in a similar amount in both matrices. The compound was tested for its radical-scavenging and antioxidant capabilities, by measuring its ability to scavenge DPPH (2,2’-diphenyl-1-picyrylhydrazyl radical) and anion superoxide radical, and inhibit the formation of methyl linoleate conjugated diene hydroperoxides and TBARS (thiobarbituric acid reactive species).

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Both $\alpha$- and $\beta$-Carotene, but Not Tocopherols
and Vitamin C, Are Inversely Related to
15-Year Cardiovascular Mortality in Dutch
Elderly Men$^{1,2}$

Brian Buijsse$^{3-5}$ Edith J. M. Feskens$^3$ Lemogang Kwape,$^3$ Frans J. Kok,$^3$ and Daan Kromhout$^{3,6,*}$

$^3$Division of Human Nutrition, Wageningen University, Wageningen, 6700 EV The Netherlands; $^4$National Institute for Public Health and the Environment, (RIVM), Bilthoven, 3720 BA The Netherlands; $^5$German Institute for Human Nutrition (Dife), Department of Epidemiology, Nuthetal, 14558 Germany; and $^6$Division of Epidemiology and Community Health, University of Minnesota, Minneapolis, MN 55454

Abstract

The role of $\beta$-carotene, $\alpha$-tocopherol, and vitamin C in the prevention of cardiovascular diseases (CVD) is controversial. Prospective studies on $\gamma$-tocopherol and carotenoids other than $\beta$-carotene are sparse. We assessed relations between the intake of different carotenoids, $\alpha$- and $\gamma$-tocopherol, and vitamin C with 15-y CVD mortality in elderly men who participated in the Zutphen Elderly Study. Information on diet and potential confounding factors was collected in 1985, 1990, and 1995. In 1985, 559 men (mean age $\sim$72 y) free of chronic diseases were included in the current analysis. After 15 y of follow-up, comprising 5744 person-years, 197 men had died from CVD. After adjustment for age, smoking, and other potential
Inductive Reasoning:
Separating ourselves from living foods

Loss of Relationship Between Molecules Outside of a Living Structure

Living Matter

- d-alpha
- d-beta
- d-gamma
Oranges

- 170 phytochemicals
- 60 bioflavonoids
- 20 carotenoids
- Vitamin C
- Folic acid
- Potassium
- Fiber

Dr. Duke's - Phytochemical and Ethnobotanical Databases

http://www.ars-grin.gov/duke/
Orange Constituents

- **2'-TRANS-O-FERULOYL-GALACTARIC ACID** Pericarp: DUKE1992A
- **2'-TRANS-O-P-COUMAROYL-GALACTARIC ACID** Pericarp: DUKE1992A
- **2'-TRANS-O-P-COUMAROYL-GLUCARIC ACID** Pericarp: DUKE1992A
- **2,4-TRANS-O-FERULOYL-GLUCARIC ACID** Pericarp: DUKE1992A
- **2-METHYL-1-PROPANOL** Fruit Juice 0.07 ppm: DUKE1992A
- **BETA-CAROTEN-8-AL** Pericarp: DUKE1992A
- **BETA-CAROTEN-8-AL** Pericarp: DUKE1992A
- **BETA-CAROTENONE** Fruit 1 - 28 ppm: DUKE1992A
- **BETA-CITRAURIN** Pericarp: DUKE1992A
- **BETA-CRYPTOXANTHIN** Fruit: JPH
- **BETA-CUBE BENE** Fruit 10 ppm: DUKE1992A
- **BETA-ELEMENE** Fruit 5 ppm: DUKE1992A
- **BETA-SINESAL** Fruit 6 ppm: DUKE1992A Pericarp: JPH
- **BETA-STOSTEROL** Fruit: DUKE1992A
- **BETA-ZEACAROTENE** Pericarp: DUKE1992A
- **BETAINS** Fruit 390 - 630 ppm: DUKE1992A
- **BIRON** Fruit 1.89 - 27.5 ppm: DUKE1992A
- **BROMINE** Fruit: DUKE1992A
- **BUTYRIC ACID** Fruit: DUKE1992A
- **CADMIUM** Fruit 0.001 - 0.138 ppm DUKE1992A
- **CAFFEIC ACID** Fruit 36 - 50 ppm DUKE1992A
- **CALCITRIOL** Fruit 210 - 5,615 ppm DUKE1992A
- **CAPROIC ACID** Fruit: DUKE1992A
- **CAPRIC ACID** Fruit: DUKE1992A
- **CAPRYLIC ACID** Fruit: DUKE1992A
- **CARBOHYDRATES** Fruit 99,000 - 887,125 ppm DUKE1992A
- **CAROTENODIOL** Fruit 12 - 35 ppm DUKE1992A
- **CARVONE** Fruit 2 - 10 ppm DUKE1992A
- **CARYOPHYLLENE** Pericarp: DUKE1992A
- **CHLORINE** Fruit 12 - 32 ppm DUKE1992A
- **CHOLESTEROL** Fruit: DUKE1992A
- **CHOLINE** Fruit 70 - 160 ppm DUKE1992A
- **CHROMIUM** Fruit 0.005 - 0.385 ppm DUKE1992A
- **CITRABASE** Root Bark 14 ppm: DUKE1992A
- **CITRACRIDONE** Root Bark 400 ppm: DUKE1992A
- **CITRIC ACID** Fruit 5,600 - 9,800 ppm DUKE1992A
- **CITRONELLAL** Fruit 55 ppm: DUKE1992A
- **COPAL** Fruit 0.002 - 0.055 ppm DUKE1992A
- **COPPER** Fruit 0.44 - 5.5 ppm DUKE1992A
- **CRENULATION** Root Bark 60 ppm: DUKE1992A
- **CRYPTOFAN** Pericarp: DUKE1992A
- **CRYPTOXANTHIN** Fruit: DUKE1992A
- **CRYPTOXANTHIN-3,5,6,6'-DIEPOXIDE** Pericarp: DUKE1992A
- **CYANIDIN-3-GLUCOSIDE** Fruit: DUKE1992A
- ** CYSTEINE** Fruit 100 - 255 ppm DUKE1992A

### Chemicals

- **2-Trans-O-Feruloyl-Galactaric Acid** Pericarp: DUKE1992A
- **2-Trans-O-P-Coumaroyl-Galactaric Acid** Pericarp: DUKE1992A
- **2-Trans-O-P-Coumaroyl-Glutaric Acid** Pericarp: DUKE1992A
- **2,4-Trans-O-Feruloyl-Glutaric Acid** Pericarp: DUKE1992A
- **2-Methyl-1-Propanol** Fruit Juice 0.07 ppm: DUKE1992A
- **Beta-Carotene-8-Al** Pericarp: DUKE1992A
- **Beta-Carotene-8-Al** Pericarp: DUKE1992A
- **Beta-Carotene** Fruit 1 - 28 ppm: DUKE1992A
- **Beta-Citraurin** Pericarp: DUKE1992A
- **Beta-Cryptoxanthin** Fruit: JPH
- **Beta-Cube Bence** Fruit 10 ppm: DUKE1992A
- **Beta-Elemene** Fruit 5 ppm: DUKE1992A
- **Beta-Sinesal** Fruit 6 ppm: DUKE1992A Pericarp: JPH
- **Beta-Stosterol** Fruit: DUKE1992A
- **Beta-Zeacarotene** Pericarp: DUKE1992A
- **Betains** Fruit 390 - 630 ppm: DUKE1992A
- **Biron** Fruit 1.89 - 27.5 ppm: DUKE1992A
- **Bromine** Fruit: DUKE1992A
- **Butyric Acid** Fruit: DUKE1992A
- **Cadmium** Fruit 0.001 - 0.138 ppm DUKE1992A
- **Caffeic Acid** Fruit 36 - 50 ppm DUKE1992A
- **Calcium** Fruit 210 - 5,615 ppm DUKE1992A
- **Campesterol** Fruit: DUKE1992A
- **Capric Acid** Fruit: DUKE1992A
- **Caproic Acid** Fruit: DUKE1992A
- **Caprylic Acid** Fruit: DUKE1992A
- **Carbohydrates** Fruit 99,000 - 887,125 ppm DUKE1992A
- **Carotenoids** Fruit 12 - 35 ppm DUKE1992A
- **Carvone** Fruit 2 - 10 ppm DUKE1992A
- **Caryophyllene** Pericarp: DUKE1992A
- **Chlorine** Fruit 12 - 32 ppm DUKE1992A
- **Cholesterol** Fruit: DUKE1992A
- **Choline** Fruit 70 - 160 ppm DUKE1992A
- **Chromium** Fruit 0.005 - 0.385 ppm DUKE1992A
- **Citrabase** Root Bark 14 ppm: DUKE1992A
- **Citracridone** Root Bark 400 ppm: DUKE1992A
- **Citric Acid** Fruit 5,600 - 9,800 ppm DUKE1992A
- **Citronellal** Fruit 55 ppm: DUKE1992A
- **Copal** Fruit 0.002 - 0.055 ppm DUKE1992A
- **Copper** Fruit 0.44 - 5.5 ppm DUKE1992A
- **Crenulation** Root Bark 60 ppm: DUKE1992A
- **Cryptofan** Pericarp: DUKE1992A
- **Cryptoxanthin** Fruit: DUKE1992A
- **Cryptoxanthin-3,5,6,6'-Diepoxide** Pericarp: DUKE1992A
- **Cyanidin-3-Glucoside** Fruit: DUKE1992A
- **Cysteine** Fruit 100 - 255 ppm DUKE1992A
Orange Cont...

- DEACYL-NOMILIN Seed: DUKE1992A
- DECANAL Fruit 10 - 60 ppm DUKE1992A
- DELPHINIDIN-3-GLUCOSIDE Fruit: DUKE1992A
- DELTA-CADINENE Pericarp: DUKE1992A
- DIHYDROKAEMPFEROL-8'-METHYL-ETHER-7-O-RHAMNOSIDE Fruit: DUKE1992A
- DIOSMIN Pericarp: DUKE1992A
- DODECANAL Fruit 5 - 20 ppm DUKE1992A
- EO Fruit 10,000 ppm: DUKE1992A
- EPOXY-NOOTKATONE Pericarp: DUKE1992A
- EPOXY-VALENCENE Fruit: DUKE1992A
- ETA-CAROTENE Pericarp: DUKE1992A
- ETHANOL Fruit Juice 64 - 900 ppm DUKE1992A
- ETHYL-ACETATE Fruit Juice 0.01 - 0.58 ppm DUKE1992A
- ETHYL-BUTYRATE Fruit Juice 0.08 - 1.02 ppm DUKE1992A
- FARNESENE Fruit 2 - 7 ppm DUKE1992A
- FATT Fruit 1,100 - 16,000 ppm DUKE1992A
- FERULIC-ACID Fruit 10 - 19 ppm DUKE1992A
- FERULOYL-PUTRESCINE Fruit 5 ppm: DUKE1992A
- FIBER Fruit 3,740 - 47,000 ppm DUKE1992A
- FLAVOXANTHIN Pericarp: DUKE1992A
- FLUORINE Fruit 0.04 - 0.76 ppm DUKE1992A
- FOLACIN Fruit 2 ppm: DUKE1992A
- FR Juice: DUKE1992A
- FRUCTOSE Fruit 23,800 ppm: DUKE1992A
- GALACTAN Fruit: DUKE1992A
- GALACTOSE Fruit: DUKE1992A
- GALACTURONIC-ACID Fruit: DUKE1992A
- GAMMA-AMINOBUTYRIC-ACID Fruit 40 - 730 ppm DUKE1992A
- GAMMA-TERPINENE Fruit 10 ppm: DUKE1992A, Fruit Juice 0.04 - 0.46 ppm DUKE1992A
- GERANIAL Fruit 6 - 350 ppm DUKE1992A
- GERANIOL Fruit 50 ppm: DUKE1992A
- GERANYL-OXY-PYRANOCHROMARIN Root: DUKE1992A
- GLUCOSAM Fruit: DUKE1992A
- GLUCOSE Fruit 23,600 ppm: DUKE1992A
- GLUTAMIC-ACID Fruit 60 - 7,097 ppm DUKE1992A
- GLUTAMINE Fruit 30 - 630 ppm DUKE1992A
- GLYCINE Fruit 50 - 7,097 ppm DUKE1992A
- HEPTANAL Fruit 3 - 5 ppm DUKE1992A
- HEPTULOSE Fruit: DUKE1992A
- HESPERIDIN Pericarp 40,600 - 63,500 ppm DUKE1992A
- HESPERIDIN-7-O-ALPHA-L-RHAMNO-GLUCOSIDE Fruit: DUKE1992A
- HEXANAL Fruit 1 - 2 ppm DUKE1992A, Fruit Juice 0.02 - 0.65 ppm DUKE1992A
- HEXANOL Fruit Juice 0.02 - 0.22 ppm DUKE1992A
- HISTIDINE Fruit 180 - 1,359 ppm DUKE1992A
- HORDENINE Fruit: DUKE1992A
- IRON Fruit 1 - 8 ppm DUKE1992A
- ISOCAPROIC-ACID Fruit: DUKE1992A
- ISOLEUCINE Fruit: 250 - 1,888 ppm DUKE1992A
- ISOLUTEIN Pericarp: DUKE1992A
- ISOPENTENYL-PSORALENS Fruit: DUKE1992A
- ISOPRENE Essential Oil: DUKE1992A
- ISORHOFOFOLIN Pericarp: DUKE1992A
- ISOSAKURANETIN Fruit: DUKE1992A
- JASMONIC-ACID Fruit: DUKE1992A
- LEAD Fruit 0.02 - 1.1 ppm DUKE1992A
- LEUCINE Fruit 230 - 1,136 ppm DUKE1992A
- LIMONENE Fruit 8,300 - 9,700 ppm DUKE1992A, Fruit Juice 1 - 278 ppm DUKE1992A
- LIMONEXIC-ACID Fruit: DUKE1992A
- LIMONIN Fruit: DUKE1992A
- LIMONATE-A-RING-LACTONE Fruit: DUKE1992A
- LINALOL Fruit 30 - 530 ppm DUKE1992A, Fruit Juice 0.15 - 4.69 ppm DUKE1992A
- LINDOLEIC-ACID Fruit 180 - 1,359 ppm DUKE1992A
- LITHIUM Fruit 0.108 - 1.54 ppm DUKE1992A
- LOCHNOCARPOL-A Root: DUKE1992A
- LUTEIN Fruit 3 ppm: DUKE1992A
- LUTEIN-7-O-ALPHA-L-RHAMNO-GLUCOSIDE Fruit: DUKE1992A
- LUTEIN-7-O-BETA-D-RUTINOSIDE Leaf: DUKE1992A
- LUTEOXANTHINS Fruit 6 ppm: DUKE1992A
- LYSINE Fruit 470 - 3,548 ppm DUKE1992A
Orange Cont...

- **MAGNESIUM** Fruit 98 - 1,075 ppm DUKE1992A
- **MALIC-ACID** Fruit 600 - 2,000 ppm DUKE1992A
- **MALONIC-ACID** Plant: DUKE1992A
- **MANGANESE** Fruit 8 ppm; DUKE1992A
- **MANNOSE** Fruit: DUKE1992A
- **MERANZINE** Fruit: DUKE1992A
- **METHYL-BUTYRATE** Fruit Juice 0.01 - 0.3 ppm DUKE1992A
- **MEVALONIC-ACID** Fruit 0.5 ppm; DUKE1992A, Pericarp 6 ppm; DUKE1992A
- **MOLYBDENUM** Fruit 0.1 - 0.385 ppm DUKE1992A
- **MUTATOCHROME** Fruit: JBH
- **MUTATOXANTHIN** Fruit 2 ppm; DUKE1992A
- **MYRCENE** Fruit 69 - 210 ppm DUKE1992A
- **N-METHYL-TYRAMINE** Fruit 2 ppm; DUKE1992A
- **NARINGENIN** Pericarp 35,000 - 45,800 ppm DUKE1992A
- **NARINGENIN-4-BETA-D-GLUCOSIDE** Plant: DUKE1992A
- **NARINGENIN-RUTINOSIDE** Fruit: DUKE1992A
- **NARINGENIN-RUTINOSIDE-4-BETA-D-GLUCOSIDE** Fruit: DUKE1992A
- **NARINGIN** Fruit: DUKE1992A
- **NARINGIN-7-O-ALPHA-L-RHAMNO-GLUCOSIDE** Fruit: DUKE1992A
- **NARIRUTIN** Pericarp: DUKE1992A
- **NEO-BETA-CAROTENE** Pericarp: DUKE1992A
- **NEOCHROME-A** Pericarp: DUKE1992A
- **NEOCHROME-B** Pericarp: DUKE1992A
- **NEOHESPERIDIN** Pericarp 28,000 ppm; DUKE1992A
- **NEOHESPERIDIN-DIHYDROCHALCONE** Pericarp: DUKE1992A
- **NEOFANCIRIN** Pericarp: DUKE1992A
- **NEOXANTHIN-A** Pericarp: DUKE1992A
- **NEOXANTHIN-B** Pericarp: DUKE1992A
- **NERAL** Fruit 1 - 20 ppm DUKE1992A
- **NEROLIDO** Flower: JBH
- **NERYL-ACETATE** Fruit 10 ppm; DUKE1992A
- **NERYL-FORMATE** Fruit 10 ppm; DUKE1992A
- **NEUROSPORIN** Pericarp: DUKE1992A
- **NIPACIN** Fruit: DUKE1992A
- **NICKEL** Fruit 0.01 - 0.55 ppm DUKE1992A
- **NITROGEN** Fruit 500 - 13,845 ppm DUKE1992A
- **NOBELITIN** Fruit: DUKE1992A
- **NONANAL** Fruit 6 - 20 ppm DUKE1992A
- **NONANOL** Fruit 10 ppm; DUKE1992A
- **NOOTKATOL** Fruit: DUKE1992A
- **NOOTKATONE** Fruit 1 ppm; DUKE1992A
- **OCTAN-1-AL** Fruit: DUKE1992A
- **OCTANAL** Fruit 20 - 280 ppm DUKE1992A, Fruit Juice 0.28 ppm; DUKE1992A
- **OCTOPAMINE** Fruit 1 ppm; DUKE1992A
- **OCYL-ACETATE** Fruit 10 ppm; DUKE1992A
- **OLEIC-ACID** Fruit 20 - 1,510 ppm DUKE1992A
- **OXALIC-ACID** Fruit 87 ppm; DUKE1992A
- **P-COUMARIC-ACID** Fruit 5 - 17 ppm DUKE1992A
- **P-CYMENE** Fruit 20 ppm; DUKE1992A
- **PALMITIC-ACID** Fruit 130 - 982 ppm DUKE1992A
- **PALMITOLEIC-ACID** Fruit 30 - 226 ppm DUKE1992A
- **PANTOTHENIC-ACID** Fruit 2 - 19 ppm DUKE1992A
- **PECTIN** Fruit 1,300 - 5,900 ppm DUKE1992A
- **PECTINERASE** Fruit: DUKE1992A
- **PERILALDEHYDE** Fruit 2 ppm; DUKE1992A
- **PHENYLALANINE** Fruit 310 - 2,340 ppm DUKE1992A
- **PHOSPHORUS** Fruit 136 - 1,980 ppm DUKE1992A
- **PHYOGEN** Fruit 2 ppm; DUKE1992A
- **PHYTOLFLUENE** Fruit 4 ppm; DUKE1992A
- **POLYGALACTURONIC-ACID** Fruit: DUKE1992A
- **POTASSIUM** Fruit 1,400 - 13,772 ppm DUKE1992A
- **PROLINE** Fruit 60 - 3,473 ppm DUKE1992A
- **PROTEIN** Fruit 9,260 - 78,000 ppm DUKE1992A
- **QUINIC-ACID** Fruit: DUKE1992A
- **RIBOFLAVIN** Fruit 3 ppm; DUKE1992A
- **RUBIDIUM** Fruit 0.1 - 7.7 ppm DUKE1992A
Orange Cont...

- **SABINENE** Fruit: 10 - 60 ppm DUKE1992A Fruit Juice: 0.15 ppm DUKE1992A
- **SCUTELLAREIN** Fruit: DUKE1992A
- **SELENIUM** Fruit: 0.002 ppm; DUKE1992A
- **SERINE** Fruit: 40 - 2,410 ppm DUKE1992A
- **SILICON** Fruit: DUKE1992A
- **SILVER** Fruit: 0.027 - 0.055 ppm DUKE1992A
- **SINAPIC ACID** Fruit: 7 - 19 ppm DUKE1992A
- **SINENSETIN** Fruit: DUKE1992A
- **SODIUM** Fruit: 29 ppm; DUKE1992A
- **STACHYDRINE** Fruit: DUKE1992A
- **STIGMASTEROL** Fruit: DUKE1992A
- **STRONTIUM** Fruit: 0.054 - 110 ppm DUKE1992A
- **SUBAPHYLIN** Fruit: JBH Leaf; JBH
- **SUCCINIC ACID** Fruit: DUKE1992A
- **SUCROSE** Fruit: 47,000 ppm; DUKE1992A
- **SUGARS** Fruit: 39,600 - 119,800 ppm DUKE1992A
- **SULFUR** Fruit: 46 - 1,000 ppm DUKE1992A
- **SYNEPHRINE** Fruit: 15 - 43 ppm DUKE1992A
- **TANGERETIN** Fruit: DUKE1992A
- **TAU-CAROTENE** Pericarp: DUKE1992A
- **TERPINEN-4-OL** Fruit: 6 - 550 ppm DUKE1992A
- **TERPINOLENE** Fruit: 10 ppm; DUKE1992A
- **TETRA-O-METHYL-SCUTELLAREIN** Fruit: DUKE1992A
- **TETRADECANAL** Fruit: 5 - 9 ppm DUKE1992A
- **THIAMIN** Fruit: 1 - 7 ppm DUKE1992A
- **THreonine** Fruit: 150 - 1,132 ppm DUKE1992A
- **TITANIUM** Fruit: 0.135 - 3.85 ppm DUKE1992A
- **TRANS-2-HEXENOL** Fruit Juice: 0.1 ppm; DUKE1992A
- **TRYPTOPHAN** Fruit: 90 - 680 ppm DUKE1992A
- **TYRAMINE** Fruit: 3 ppm; DUKE1992A
- **TYROSINE** Fruit: 160 - 1,208 ppm DUKE1992A
- **URONIC ACID** Fruit: DUKE1992A
- **VALENCENE** Fruit: 10 - 20 ppm DUKE1992A Fruit Juice: 0.04 - 15.3 ppm DUKE1992A
- **VALENCIAXANTHIN** Fruit: 3 ppm; DUKE1992A
- **VALINE** Fruit: 100 - 1,020 ppm DUKE1992A
- **VIOAXANTHIN** Fruit: DUKE1992A
- **VIT-B-6** Fruit: 1 - 5 ppm DUKE1992A
- **VITEXIN-XYLOSIDE** Fruit: DUKE1992A
- **WATER** Fruit: 839,000 - 898,000 ppm DUKE1992A
- **XYLAN** Fruit: DUKE1992A
- **XYLOSE** Fruit: DUKE1992A
- **ZEAXANTHIN** Fruit: 2 ppm; DUKE1992A
- **ZETA-CAROTENE** Fruit: 2 ppm; DUKE1992A
- **ZINC** Fruit: 0.9 - 13 ppm DUKE1992A
- **ZIRCONIUM** Fruit: 0.5 - 1.1 ppm DUKE1992A

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**Additional Information**

- **ZETA-CAROTENE** Leaf: 0.33 ppm DUKE1992A
Phytonutrient Cascade

Phytochemicals
- Carotenoids
  - Α-Carotene
  - Β-Carotene
  - Β-Cryptoxanthin
  - Lutein
  - Zeaxanthin
  - Astaxanthin
  - Lycopene
- Phenolics
  - Phenolic acids
- Alkaloids
- Nitrogen-containing compounds
- Organosulfur compounds
  - Isothiocyanates
  - Indoles
  - Allylic sulfur compounds
- Flavonoids
- Stibenes
- Coumarins
- Tannins
- Hydroxybenzoic acids
  - Gallic
  - Protocatechuic
  - Vanillic
  - Syringic
- Hydroxycinnamic acids
  - p-Coumaric
  - Caffeic
  - Ferulic
  - Sinapic
- Flavonols
  - Quercetin
  - Kaempferol
  - Myricetin
  - Galangin
  - Fisetin
- Flavones
  - Apigenin
  - Chrysin
  - Luteolin
- Flavanols (Catechins)
  - Catechin
  - Epicatechin
  - epigallocatechin
  - epicatechin gallate
- Flavanones
  - Eriodictyol
  - Hesperitin
  - Narigenin
- Anthocyanidins
  - Cyanidin
  - Pelargonidin
  - Delphinidin
  - Peonidin
  - Malvidin
- Isoflavonoids
  - Genistein
  - Daidzein
  - Glycitein
  - Formononetin

Number of Essential Nutrients May be Endless
Triage Theory & ACES

Broccoli contain glucosinolates that turn on enzymes that detoxify

Blueberries have a dramatic ability to penetrate cell membranes and decrease levels of inflammation

Oxford University: No benefit for “Pure” C, E, or Beta on these factors:

Heart Disease, Cancer, Cataracts, Bone Fractures, Mental Decline
MRC/BHF Heart Protection Study of antioxidant vitamin supplementation in 20 536 high-risk individuals: a randomised placebo-controlled trial

Heart Protection Study Collaborative Group

Collaborators and participating hospitals are listed in Lancet 2002; 360: 7–22

Summary

Background
It has been suggested that increased intake of various antioxidant vitamins reduces the incidence rates of vascular disease, cancer, and other adverse outcomes.

Methods
20 536 UK adults (aged 40–80) with coronary disease, other occlusive arterial disease, or diabetes were randomly allocated to receive antioxidant vitamin supplementation (600 mg vitamin E, 250 mg vitamin C, and 20 mg 8-carotene daily) or matching
Triage Theory & Carotenoids

Tomatoes and carotenoid rich foods are highly correlated with a lower risk of cancer

- *Journal of the National Cancer Institute*
  - Lycopene (carotenoids) not as effective as tomatoes for the prostate

- *American Journal of Clinical Nutrition*
  - Food carotenoids work against coronary artery disease, supplements don’t
Tomatoes or Lycopene Versus Prostate Cancer: Is Evolution Anti-Reductionist?

Peter H. Gann, Frederick Khachik

Occasionally, but not often, positive things happen in the field of cancer prevention science to popular, good-tasting foods. Cruciferous vegetables have been the subject of intense study, but these foods might be—to modify the expression—an easy pill but a hard food for the public to swallow. By contrast, tomatoes (scientifically classified as a fruit) have overcome their earlier reputation as an inedible and possibly toxic food to become one of the most heavily consumed fruits or vegetables in the Western diet—mostly in the form of pizza, salsa, chili, pasta sauce, and ketchup. Americans consume an average of 91 pounds of tomatoes per capita per year, second only to potatoes among all fruits and vegetables.

This issue of the Journal brings good news to tomato eaters. Boyle et al. (1) report, in a well-controlled study using the N-methyl-N-nitrosourea (NMU)—androgen rat carcinogenesis model, that a diet containing whole tomato powder inhibited the development of prostate cancer compared to a control diet, whereas a diet containing a pure synthetic lycopene supplement did not. In the tomato powder group, the risk of developing most observational and indeed human experimental evidence to date concerning the possible benefit of lycopene versus prostate cancer is actually based on consumption of lycopene-rich foods such as tomatoes rather than lycopene itself, which has not been used as a supplement long enough or widely enough to facilitate epidemiologic research. In studies relating serum or plasma concentrations to risk, lycopene concentrations might only serve as a marker for consumption of the relevant foods (5).

The ultimate biologic activity of a given food or nutrient depends on a large number of variables, including food processing and preparation method, gastrointestinal tract physiology, interactions between compounds in the food, and interactions between foods eaten together at the same meal. The biologic effect of a given food might even be influenced by how rapidly we eat it, as is seen in the literature on glycemic load. It has already been established that heat, mechanical processing, and ingestion together with oil or fat alters the bioavailability of lycopene and similar compounds by releasing them from intracellular compartments and promoting intestinal absorption (6). In addition to increased known...
“Carotenoids and other secondary plant compounds evolved as sets of interacting compounds, and because of this complexity it limits the usefulness of reductionist approaches that seek to identify single protective compounds.”

Journal of the National Cancer Institute 2003;95:1578-86
What is a Vitamin Anyway?
What is a Vitamin Anyway?

- Short-term deficiencies such as scurvy, Beriberi and rickets.
- Long-term deficiencies such as heart disease, diabetes and cancer
- Casimir Funk – Vital amines
- Absorption is not the goal of nutrition; absorb anything
- Vitamins are nutrient cargo (coenzymes)
Do We Need More Vitamins?

• Vitamins are nutrient cargo (coenzymes)
• Long-term deficiencies such as heart disease, diabetes and cancer
• Quality whole food interwoven with macro nutrients, vitamins, minerals and phytonutrients appears to be the best solution
SYNTHETIC OR NATURAL— WHICH SUPPLEMENTS ARE BEST?

I will acknowledge right up front that this is a hot issue, fraught with misinformation, limited research, commercial biases and passionately held beliefs. Nonetheless, this issue affects us every day in our practice.

I’ve been puzzling over this question since the early 1970s, when I was enrolled in naturopathic medical school. Some of my teachers were inspired by recent advances that enhanced understanding of human biochemistry and were excited by the falling costs of high-dose synthetic nutrients that provided improved clinical success. Linus Pauling was lecturing widely on the wonders of “orthomolecular” medicine and promulgating the benefits of vitamin C at levels difficult to achieve from diet alone. After graduation, I attended 2 inspirational monthly study clubs, one with Jeff Bland, PhD, and the other with Jonathan Wright, MD, and Alan Gaby, MD. Both clubs provided a strong research foundation for nutritional medicine and found favorable results using synthetic supplements.

But then there were the “old timers,” who would comment now were found to be major determinants of health! I also noticed that the recognized importance of a new class of nutrients was limited by the available technology for detection and the increased understanding of human biochemistry. The final indication of the need to re-examine my assumptions on supplementation was the growing number of high-profile supplement intervention failures.

On the one hand, virtually every study shows an inverse correlation between whole foods and most chronic degenerative disease. Cardiovascular illness is a good example in which, for each increase in daily servings of fruits or vegetables consumed, we see about a 4% drop in cardiovascular disease. But what happens when we assert that a single nutrient is responsible for a specific health benefit, then synthesize it (or a close analog) and use the nutrient to treat or prevent a specific disease? The high-profile vitamin E failure studies we discussed in volume 4, issue 1, demonstrate the limitations of this approach. Why did high-dose synthetic vitamin E not work the way we expected in cardiovascular disease and actually seemed to increase some forms of the illness? Can it be explained away as a poor drug design?
Triage Theory & Folate

- Published in *British Medical Journal*
- Extremely easy to absorb
- 50% of folic acid (PGA) unmetabolized at dosages of 400 mcg or more
- Food folate in correct form: Safe
- Cautious outlook: Bioavailability not the answer
Science, medicine, and the future

Is folic acid the ultimate functional food component for disease prevention?

Mark Lucock

We are entering a new era in preventive medicine, which focuses on diet as a means to health. Folate has received much attention as a vitamin that can protect against many diseases, but do we know enough about the long term effects of supplementation?

Mankind has been relatively unsuccessful in the search for the ultimate panacea for all ills; however, in the field of functional foods, few nutritional components have so many fundamental and diverse biological properties as folic acid and related B group vitamins. Moreover, few nutrients can claim to modulate, if not overtly benefit, such a wide array of clinical conditions.

Around 2500 years ago Hippocrates first espoused the “food as medicine” philosophy, which fell into obscurity by the 19th century. The first 50 years of the 20th century saw the discovery of the essential elements and vitamins, particularly in the context of public health interventions. The 70th century is seeing a renaissance of this approach, particularly at an individual level.

Summary points

| B vitamins, particularly folate, may give considerable protection against serious diseases such as cancer, heart disease, and birth defects |
| The method of protection is by lowering homocysteine or through epigenetic mechanisms |
| Common single nucleotide polymorphisms of several genes coding for folate dependent |

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BMJ 2004;328:211–4
What does all this mean?

"You have a serious vitamin deficiency — Eat as much breakfast cereal as you can."
Nutrient Triage
Live For Today

“Sha-la-la-la-la-la-la, live for today...and don't worry 'bout tomorrow, hey, hey, hey. Sha-la-la-la-la-la-la, live for today. Live for today”

–The Grass Roots
Nutritional Longevity

Limited nutritional resources every day

Rationing: the body will always direct nutrients toward short-term health and reproductive capabilities and away from regulation and repair of cellular DNA

Virtually every metabolic pathway requires micronutrients

Creating nutritional starvation

Reason why long-term diseases (inflammation and oxidation) take time to manifest in outward symptoms
Nutritional Longevity

- Known and unknown factors – number of essential nutrients
- Absorption vs. utilization
- Phytonutrient cascade
- Vitamins are nutrient cargo – metabolically active forms
- Long-term vs. short-term benefits
Nutritional Longevity

Eat mainly a plant-based diet

Eat 7-9 (or more) servings of fruits and vegetables every day

Take a whole food multiple vitamin

Know your nutritional deficiencies

Take whole food supplements
“My own scientific career was a decent from higher to lower dimensions, led by a desire to understand life. I went from animals to cells, from cells to bacteria, from bacteria to molecules, from molecules to electrons. The story has its irony, for molecules and electrons have no life at all. On my way, life ran out between my fingers.”

Thank you for your time.

James Doherty
Director of Education
Innate Response Formulas