

PADRECC/EES Series

# Nutritional Supplements & Issues in Parkinson's Disease



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Personal/Professional Financial Relationships with Industry within the past year

| External Industry Relationships *  | Company Name(s)  | Role  |
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| Industry funds to Emory for my research                                    | Boehringer Ingelheim Pharm. Inc.<br>Schwartz/UCB<br>Ipsen, Inc.<br>MERZ Pharmaceuticals, Inc.<br>Juvantia Pharma Ltd. (Santhera Pharmaceuticals, Inc.) | 248.538 Eye Safety Study<br>SP512/Rotigotine CDS<br>Dysport 731 Trial<br>MERZ 60201-0408 (NT-201 CD Trial)<br>Juvantia Pharma Ltd. (Santhera Pharmaceuticals, Inc.) |
| Other  | NWGA Parkinson Disease Association   | Speaker honorarium 10/2008  |

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# Nutritional Issues in PD Management

## 1. Vitamins & Supplements in PD Risk & Neuroprotection

- A. Prevention & Treatment of PD
- B. Research underway



## 2. Logistical Nutrition Issues

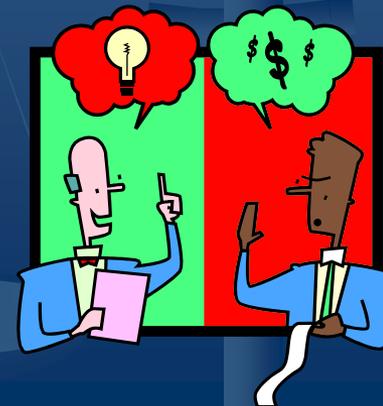
- A. Weight Loss
- B. Swallowing problems
- C. Maximizing medication effects with Diet



## 3. What's the 'Take Home' Message?

# Vitamin & Mineral Supplement Usage in PD

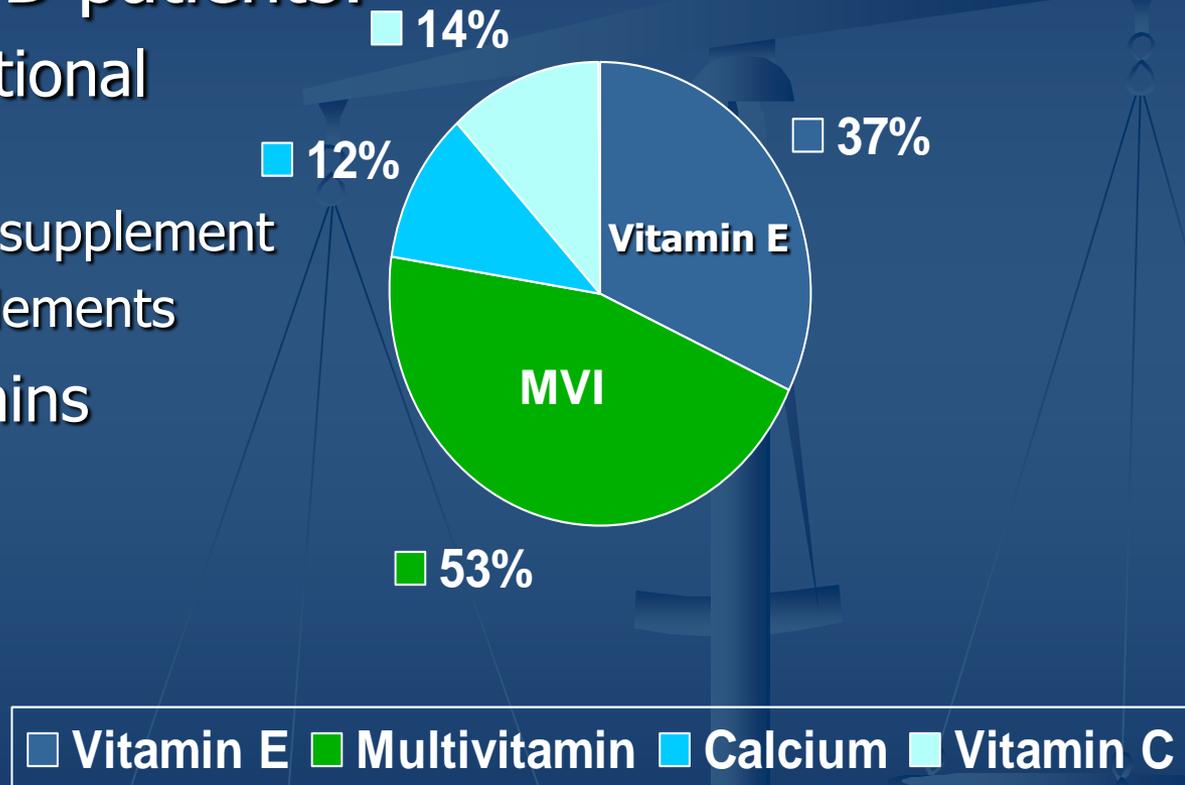
- Why Bother discussing????
  1. Your patients take them!
  2. Your patients will ask
  3. The expense is not inconsequential!



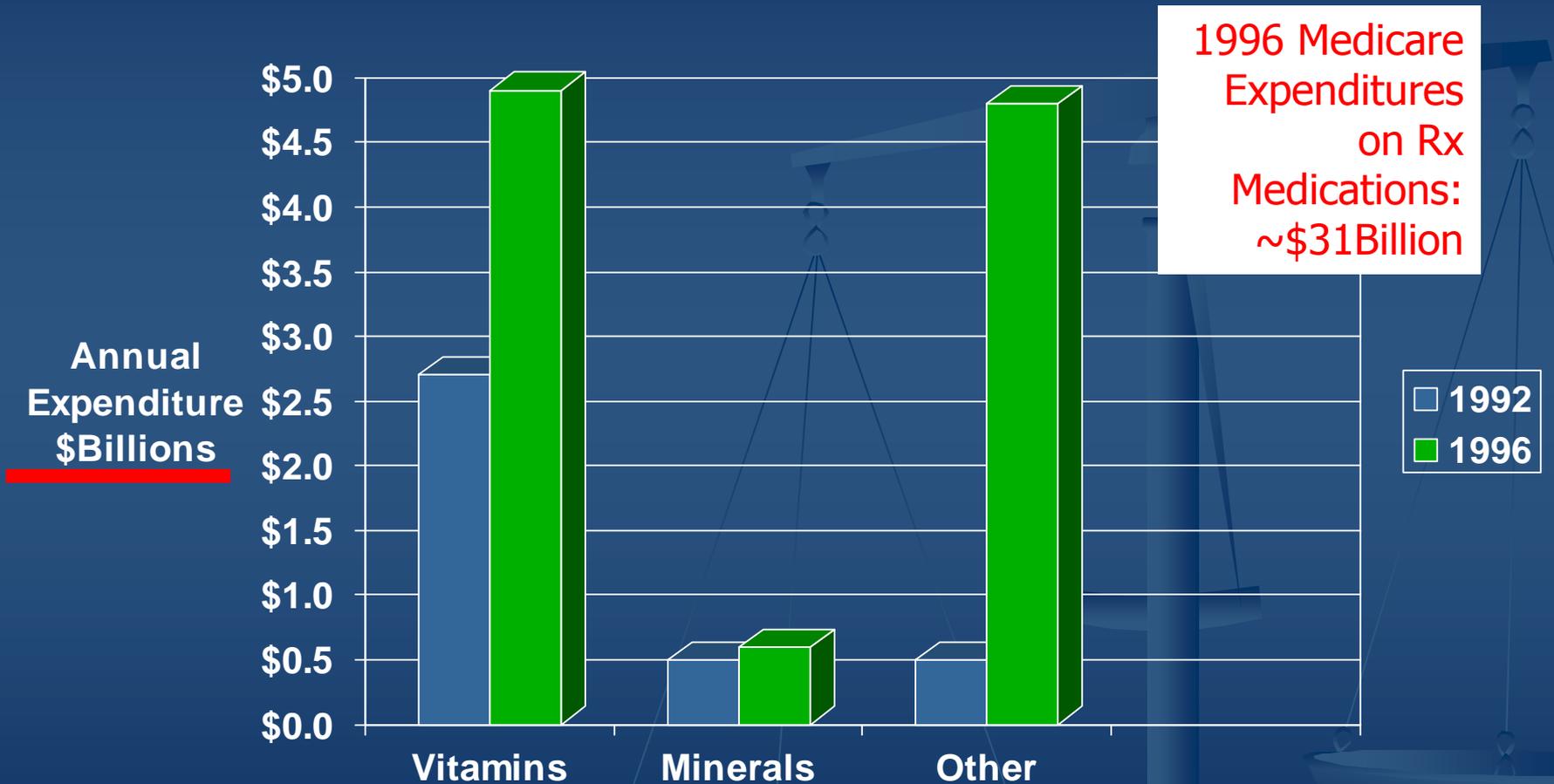
# Vitamin & Mineral Supplement Usage in PD

## ■ Survey of 120 PD patients:

- 63% took nutritional supplements
  - 40% took one supplement
  - 60%  $\geq$  2 supplements
- 53% Multivitamins
- 37% Vitamin E
- 14% Vitamin C
- 12% Calcium



# How much do they cost us?



# Cost – similar patterns worldwide

TABLE 2. Types of CT used by ethnic group and average cost of each therapy

| Complementary therapies     | Chinese n | Indian n | Malay n | Total N   | Cost/patient/month (in USD)* |
|-----------------------------|-----------|----------|---------|-----------|------------------------------|
| Traditional medicine        | 4         | 0        | 0       | 4         | 56.58                        |
| Acupuncture                 | 4         | 0        | 0       | 4         | 32.91                        |
| Vitamins/health supplements | 28 (16)   | 5 (33)   | 3 (33)  | 36 (18)   | 20.69                        |
| Massage therapy             | 25 (14)   | 3 (20)   | 3 (33)  | 31 (15)   | 52.52                        |
| Foot reflexology            | 15 (9)    | 0        | 1 (11)  | 16 (8)    | 74.20                        |
| Classes <sup>a</sup>        | 7 (4)     | 2 (13)   | 0       | 9 (5)     | 2.04                         |
| Aromatherapy                | 2 (1)     | 0        | 0       | 2 (1)     | 158.28                       |
| Total                       | 174 (100) | 15 (100) | 9 (100) | 198 (100) |                              |

Cost /pt/month vitamins/supplements  
~35% that of traditional med.

There were 84 Chinese, 8 Indians, and 5 Malays who used CTs. Among CT users, Chinese were significantly more likely to use traditional medicine and acupuncture ( $P = 0.025$  and  $0.001$ , respectively). There was no statistical difference in the interethnic group usage of the other CTs.

\*Converted to USD using the conversion rate of USD 1.00 = SGD 1.63.

<sup>a</sup>Classes refers to qigong (5 patients), taichi (2), and yoga classes (2).

# Vitamin and Dietary Supplements

- What are vitamins and Dietary supplements?
  - Cautions & Pitfalls
- Specific vitamins/supplements in PD
  - Coenzyme Q10
  - Creatine
  - Glutathione
  - Vitamin C
  - Vitamin D
  - Vitamin E



# What are vitamins?

Casimir Funk 1912 coined term:

“Vitamine” =

“vita” (life) + amine

(He wrongly thought all vitamins were amines)

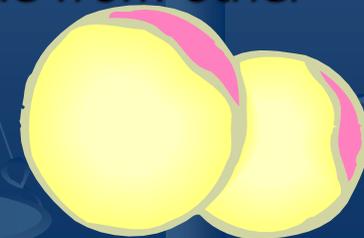
# What are vitamins?

- Organic chemicals humans require in small quantities for normal health.
  - Involved in converting food into energy



# What are vitamins?

- Organic chemicals humans require in small quantities for normal health.
  - Involved in converting food into energy
  - Classified as: Water-soluble or fat-soluble
- Must include vitamins in diet because your body usually can't make them.
  - Some (Vitamins A,D, niacin) can be made from other components in diet
  - Do not supply calories



Fat Cells

# What are Water Soluble Vitamins?

Not stored in your body → Urinate out extra!

- Include:

- Vitamin C

- Biotin

- Seven B-vitamins:

1. B1 or thiamin

2. B2 or riboflavin

3. B3 or niacin

4. B5 or pantothenic acid

5. B6 or pyridoxine

6. B9 folic acid and

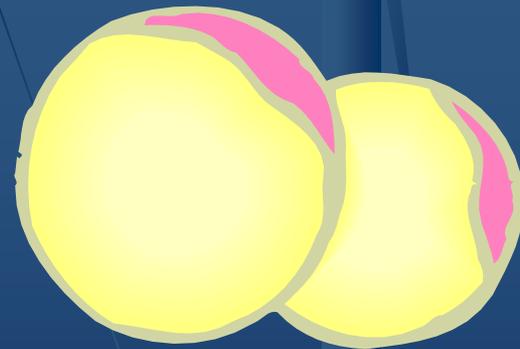
7. B12 or cobalamin



# What are Fat Soluble Vitamins?

- Stored in fat
  - Can become toxic!
- Include:

Vitamin A  
Vitamin D  
Vitamin E  
Vitamin K



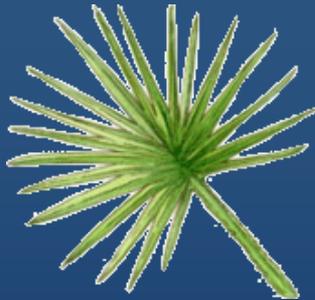
Fat Cells

# What are dietary supplements?

## Dietary Supplement Health & Education Act of 1994:

Labeled as "Dietary Supplement"

- Contains one or more: vitamins, minerals, herbs or botanicals (not tobacco), amino acids



SAW PALMETTO  
*(Serenoa repens)*



EXAMPLE: L-GLUTAMINE  
"-AMINE"

# What are dietary supplements?

## Dietary Supplement Health & Education Act of 1994:

Labeled as "Dietary Supplement"

- Ingested in tablet, capsule, liquid or pill form.
- Not represented to be conventional food or sole meal item or diet.



# Dietary Supplements

Can make broad claims...

"... Clinically Shown To Improve Heart Function\*

Antioxidant - Helps Support Heart Performance\*

No Artificial Flavors

No Preservatives

No Chemical Solvents, Yeast, Starch or Gluten

\*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease. "



# Dietary Supplements

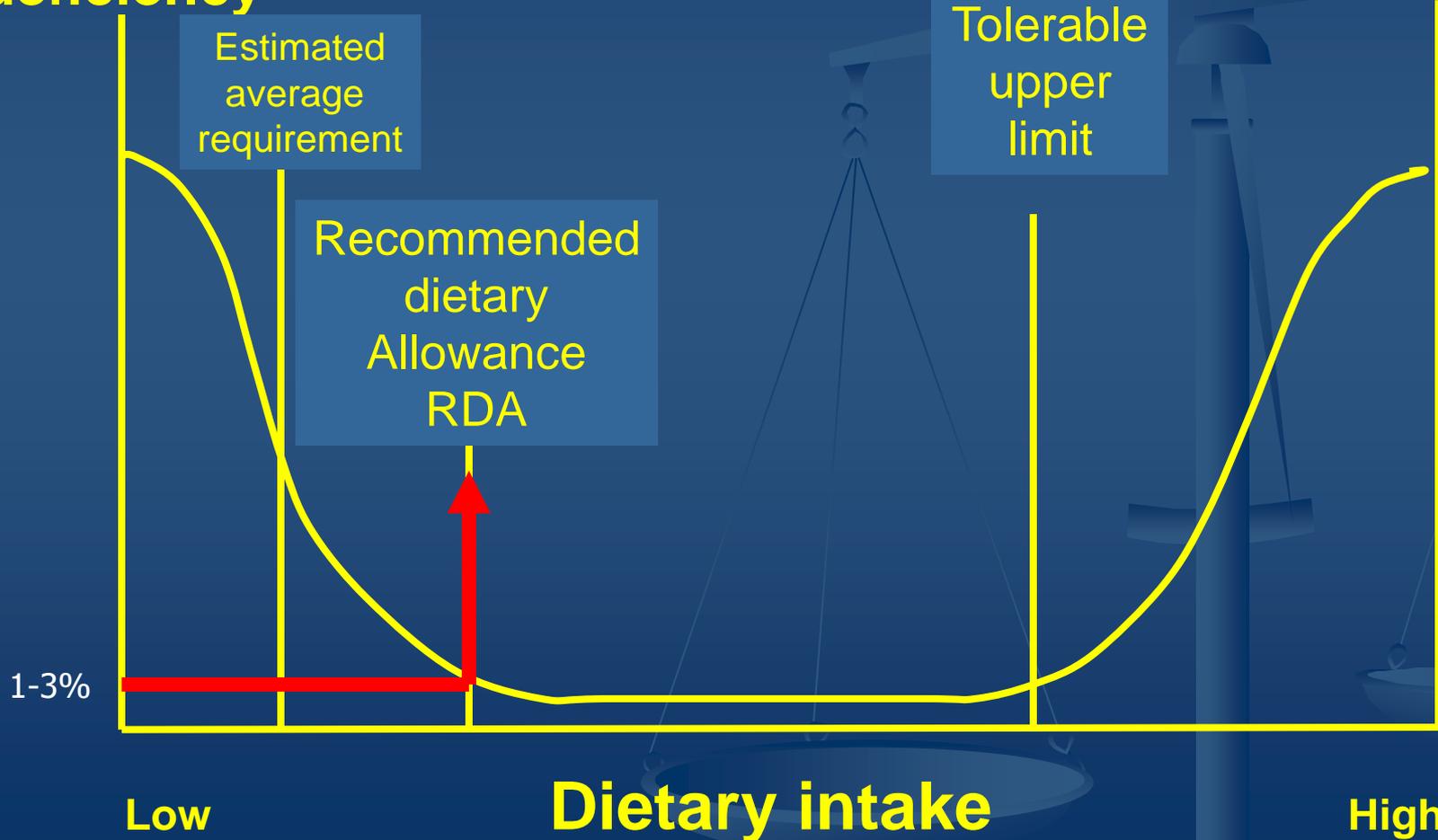
- IF promoted on its label as a ***treatment, prevention or cure*** for a specific disease or condition
  - considered unapproved & illegal drug.
- Regulated as FOODS, not drugs.
- UNLIKE drugs,
  - Not preapproved for safety and efficacy
  - Special Nutritionals: Can be more tightly regulated if 'vulnerable' population (infant formula)



# Recommended Dietary Intakes

Risk of  
deficiency

Risk of  
toxicity



# Dietary Factors in Parkinson's Disease: Role of Food Groups and Specific Foods

Anderson et al studied food intake and risk of PD

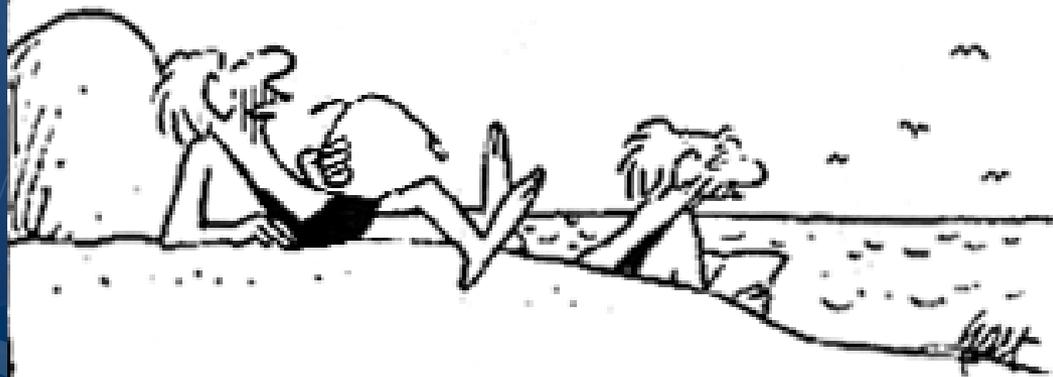
- No relationship to PD risk:
  - Fruits, vegetables, meats, bread and cereals
  - Foods containing vitamins A, C, E, or iron
- Vitamin use in general not related to PD risk, HOWEVER
  - Trend of ↑'d risk for intake of vitamin A supplements.
- ↑'d PD risk w/ increasing intake:
  - Foods containing animal fat
  - Vitamin D
- **CONCLUSIONS**
  - Support previous findings of no association of past intake with most food groups & PD risk
  - Confirm an increased risk of PD associated with foods containing animal fat

# Why? Vitamins, Supplements & Neuroprotection & Oxidation

B.C.

WHAT'S  
OXIDATION,  
ANYWAY?

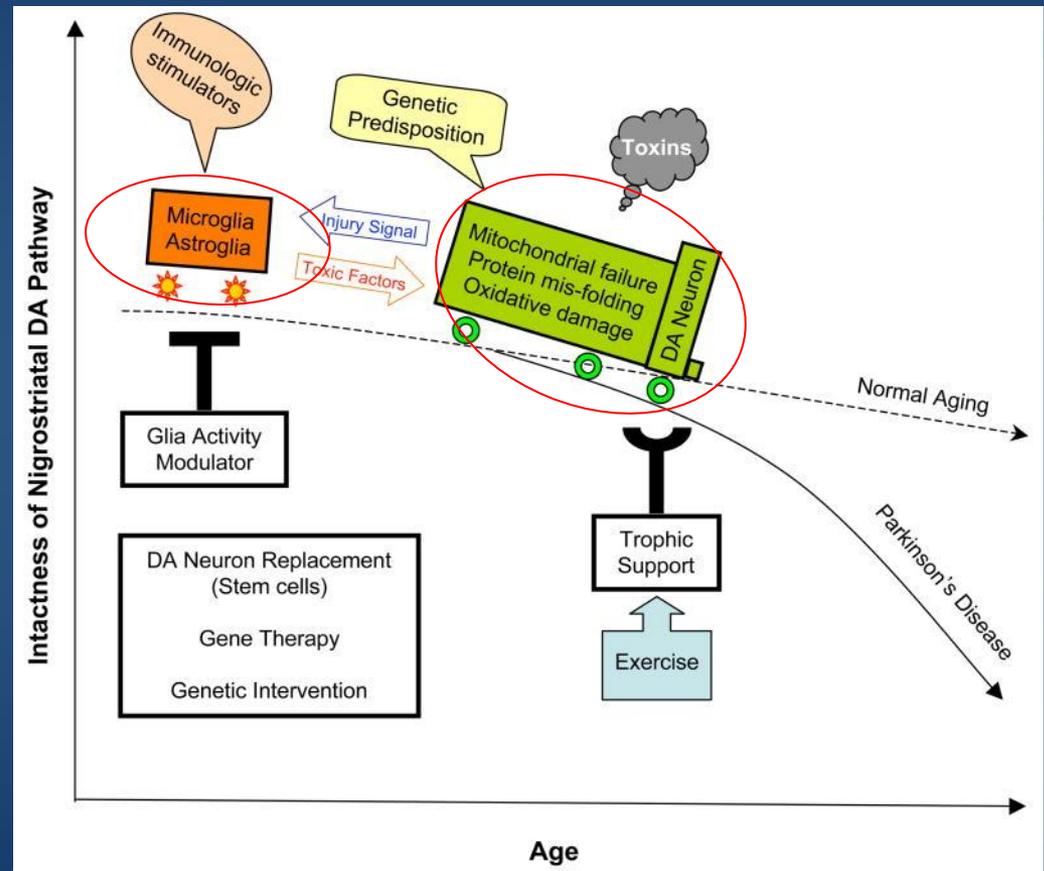
GEE, I DON'T KNOW... MY  
SCIENCE IS A LITTLE RUSTY.



© 1988 CREATORS PUBLISHING, INC.

# Potential PD Neuroprotection – Multiple Mechanisms

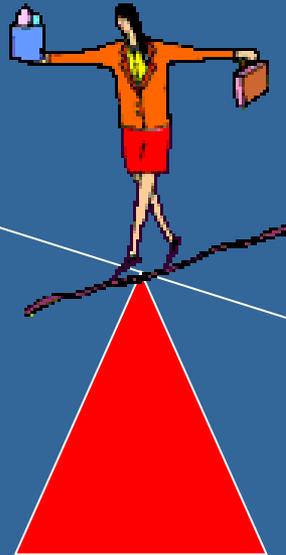
- Environmental factors
  - Inflammation
  - Toxin exposures
- Excitotoxicity
  - Mitochondrial dysfunction
  - Protein misfolding
  - Oxidative damage
- Apoptosis
- A2A receptor blockade
  - ↓glutamate; modulates inflammation



# Oxidative Stress:

An imbalance between prooxidants and antioxidants in which the prooxidants predominate (H. Sies, 1985)

## Antioxidants



## Prooxidants



<sup>1</sup> Ravina BM, Fagan SC, Hart RG, Hovinga CA, Murphy DD, Dawson TM, Marler JR (2003). Neuroprotective agents for clinical trials in Parkinson's disease. *Neurology*. 2003 Apr 22; 60(8): 1234-1240. [Abstract](#)

### Methods, Results and Compounds

Several compounds were initially identified by scientists and clinicians in government, academia and industry for evaluation but only a few were promising enough to qualify for further study in neuroprotection clinical trials. Four compounds are currently under investigation. The table below summarizes information on those compounds as well as those under consideration for future study.

### Drugs Selected for Investigation In the Neuroprotection Clinical Trial

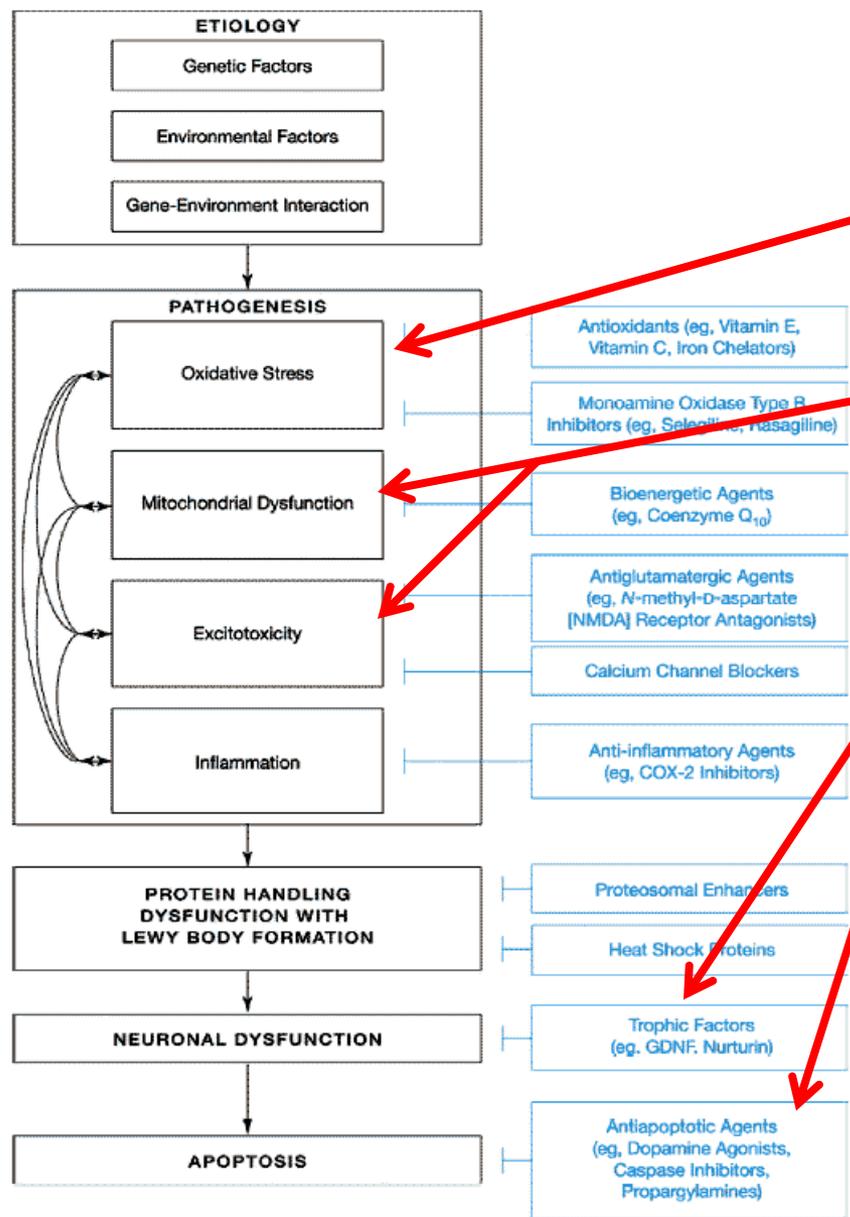
| Drug                         | Primary Mechanism                           |
|------------------------------|---|
| <a href="#">Coenzyme Q10</a> | <u>Antioxidant/Mitochondrial Stabilizer</u> |
| <a href="#">Creatine</a>     | Mitochondrial Stabilizer                    |
| <a href="#">GPI 1485</a>     | Trophic Factor                              |
| <a href="#">Minocycline</a>  | Anti-inflammatory/Anti-apoptotic            |

### Drugs Under Consideration for Future Study

| Drug                                   | Primary Mechanism                 |
|--|-----------------------------------|
| <a href="#">Amantadine</a>             | Glutamate Antagonist              |
| <a href="#">Ascorbic Acid</a>          | Antioxidant                       |
| <a href="#">Azulenyl Nitron</a>        | Antioxidant                       |
| <a href="#">Caffeine</a>               | Adenosine Antagonist              |
| <a href="#">COX-2 Inhibitors</a>       | Anti-inflammatory                 |
| <a href="#">Erythropoietin</a>         | Undetermined/Multiple             |
| <a href="#">Estrogen</a>               | Undetermined/Multiple             |
| <a href="#">Folate</a>                 | Undetermined/Multiple             |
| <a href="#">GM-1 ganglioside</a>       | Trophic Factor                    |
| <a href="#">Modafanil</a>              | Unknown                           |
| <a href="#">N-acetyl Cysteine</a>      | Antioxidant                       |
| <a href="#">Nicotine</a>               | Unknown                           |
| <a href="#">Pramipexole/Ropinirole</a> | Antioxidant/Vesicular Trafficking |
| <a href="#">Rasagiline</a>             | Anti-oxidant/Anti-apoptotic       |
| <a href="#">Remacemide</a>             | Glutamate Antagonist              |
| <a href="#">Selegiline</a>             | Antioxidant/Anti-apoptotic        |

Figure 1

Schema of Etiologic and Pathogenetic Factors That Have Been Implicated in Cell Death in Parkinson's Disease and Possible Neuroprotective Approaches

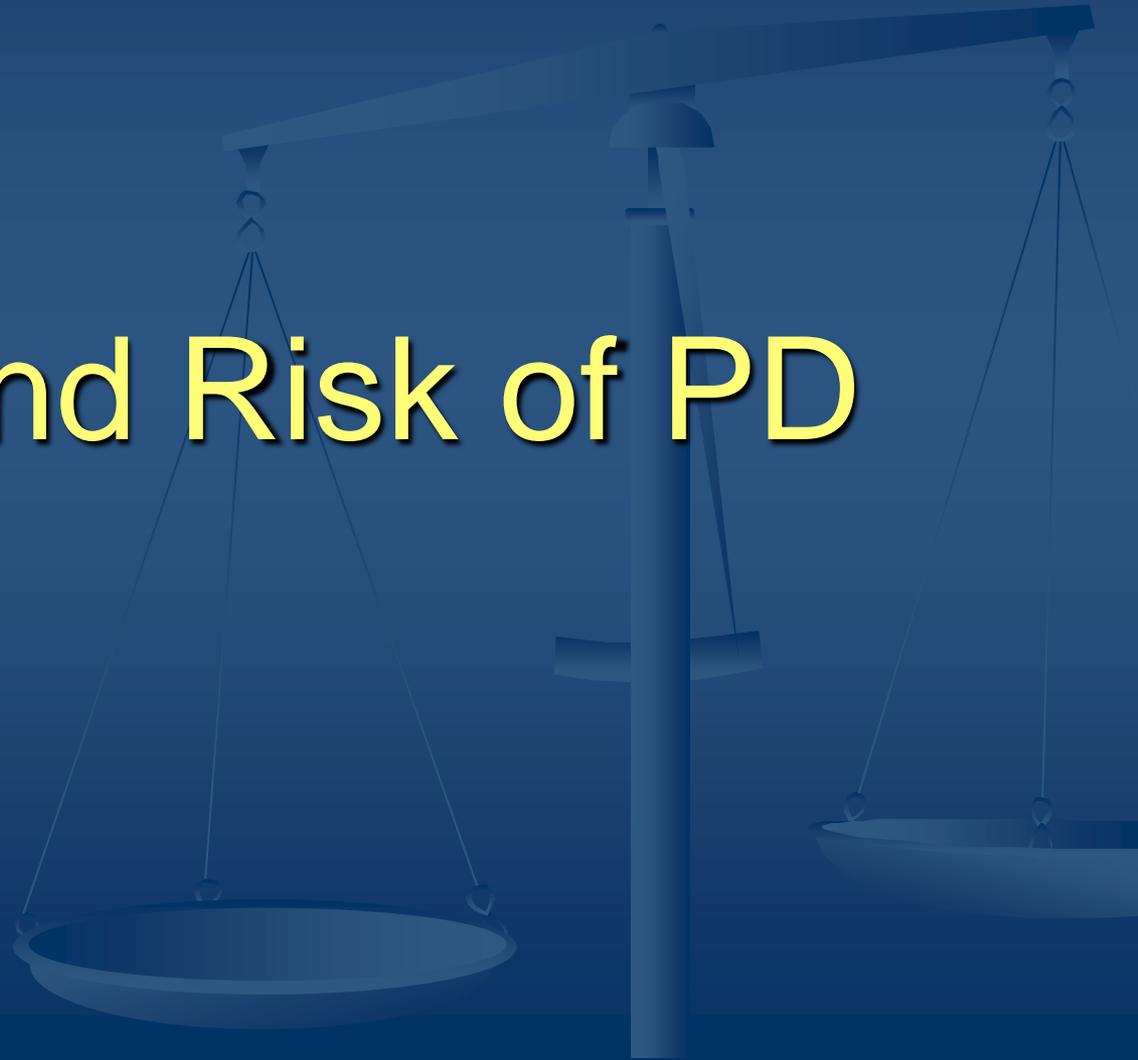


COX-2 = cyclooxygenase-2; GDNF = glial-derived neurotrophic factor.  
Reprinted with permission from reference 4.

Vit D regulates:

- Oxidative stress
- L-type Ca<sup>++</sup> channels
- Neurotrophins
- Tyrosine hydroxylase
- rate-limiting step for catecholamine prod

# Intake and Risk of PD



# Intakes of vitamins E and C, carotenoids, vitamin supplements, and PD risk

Previous data → reduction or no change in risk of PD associated with high vitamin E intake

- 371 PD cases among
  - 76,890 women followed for 14 years Nurses' Health Study
  - 47,331 men followed for 12 years Health Professionals Follow-Up Study
  - Food frequency questionnaires
- NOT associated with risk of PD
  - Multivitamins
  - Total vitamins E or C or Any vitamin E or C supplements

## HOWEVER

- PD risk reduced w/ higher consumption of
  - **Dietary** (i.e., from foods only) **vitamin E**
    - Relative risk, (highest with lowest intakes) = 0.68 (95% CI, 0.49 to 0.93)
  - Nuts (5/week vs. 1/month)
    - Relative risk = 0.57; 95% CI, 0.34 to 0.95).

# Intakes of vitamins E and C, carotenoids, vitamin supplements, and PD risk

## *Conclusions:*

- Using vitamin supplements and high intake of carotenoids do not appear to reduce the risk of PD.
- The reduction in risk of PD associated with high dietary vitamin E intake suggests that other constituents of foods rich in vitamin E may be protective.
- Alternatively, moderate amounts of vitamin E may reduce risk of PD, but this benefit may be lost with higher intakes.

*Comment:* Form of vitamin may also make a difference (DATATOP study) – more in a minute

# Vitamin C & Parkinson's

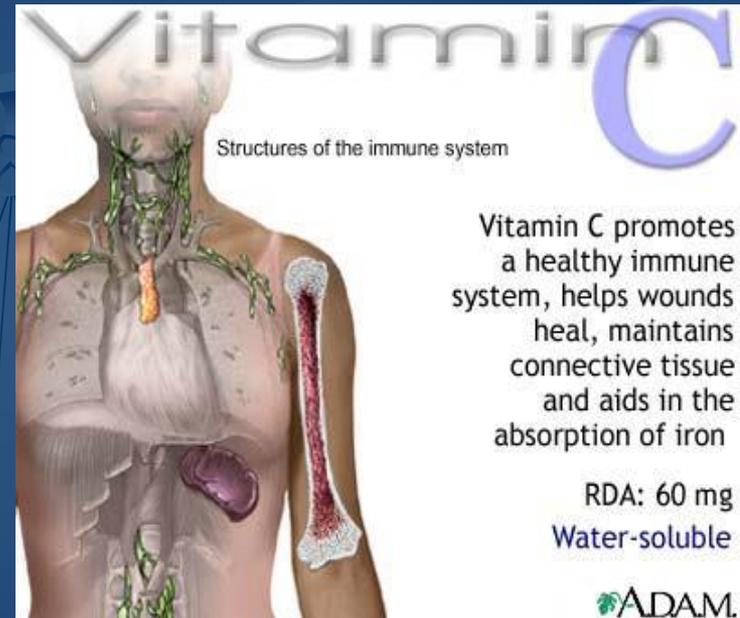
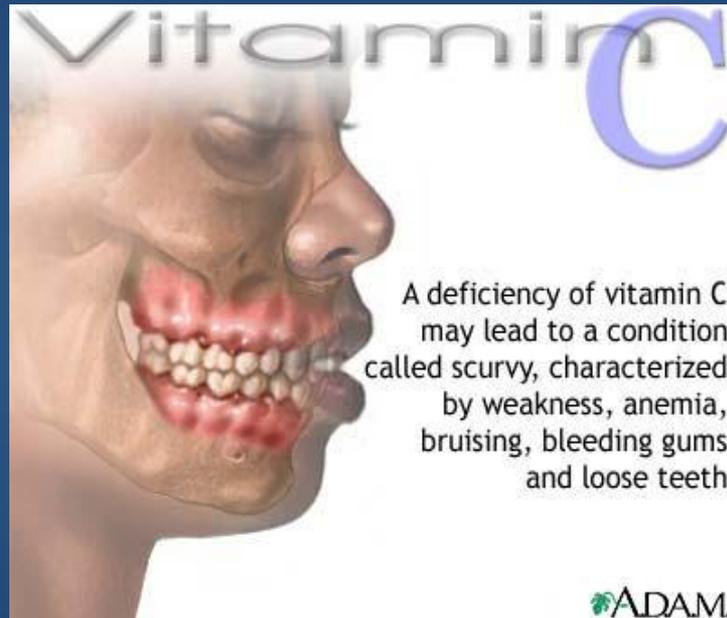
- Most potent antioxidant circulating in plasma

HOWEVER...

- Must be transported into brain
- No differences in Vit. C levels of PD pts. & control subjects (Riederer, J Neurochem 1989)
- Dietary intake – no benefit in preventing PD (Zhang, Neurology 2002)

# Vitamin C (Ascorbic Acid)

- Water-soluble antioxidant



- RDA: 75-90 mg/day (+35 mg if smoker)
- Toxicity: >2000 mg/day → Diarrhea and stomach upset

# Vitamin E

- Fat-soluble vitamin made by plants
- 2 forms:
  - Tocopherols
  - Tocotrienols
- ***Alpha-tocopherol usually sold***
  - Synthetic: dl-alpha-tocopherol (\$)
  - Natural: d-alpha-tocopherol (\$\$)
  - Take w/ fats
    - Doubles absorption c/w empty stomach



# Vitamin E & Parkinson's Disease

- Antioxidant
- PD is due (in part) to excess oxidation (oxidative stress)
- **High DIETARY intake Vit. E may be protective**  
→ Does supplementing Vit. E in PD help?

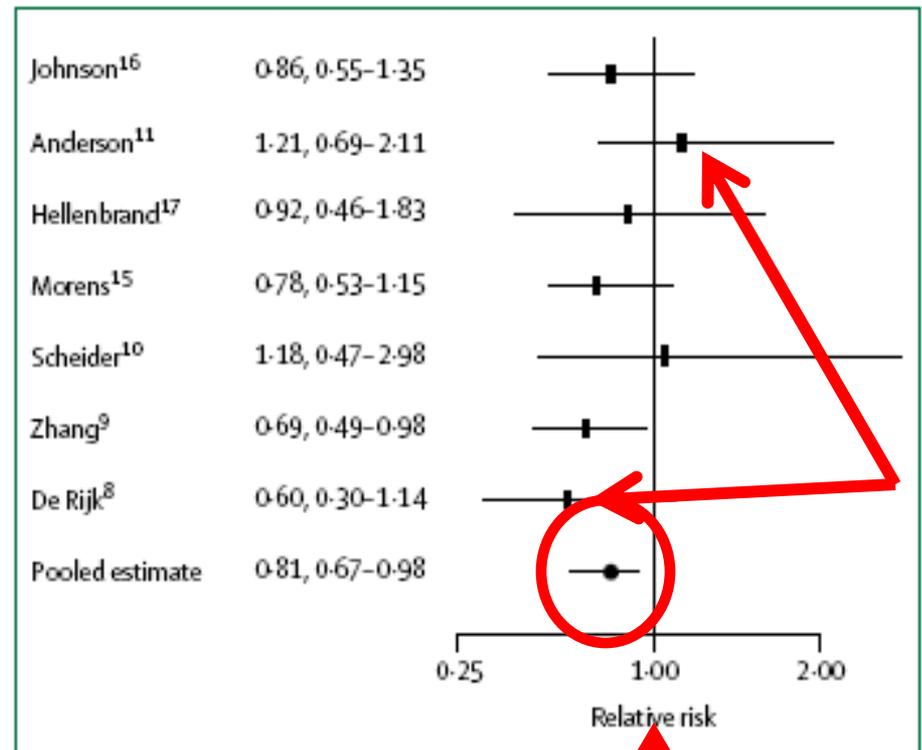


Figure 1: Relative risks and 95% CI from studies of moderate intake of dietary vitamin E and the risk of PD

# Vitamin E & Parkinson's Disease

## CONFLICTING RESULTS IN VIT. E SUPPLEMENT STUDIES:

1. "DATATOP" 1989 (800 patients) → No Benefit
2. Fahn 1992 (20 patients) → Benefit

# Vitamin E & Parkinson's Disease

## ■ Why? Possible Explanations:

### 1. Dose

2000 IU in DATATOP vs. 3200 IU Fahn's

### 2. Vitamin E forms

dl-form has ~half the activity of d-form

### 3. Vit. C used with Vit E in Fahn's study enhanced Vit. E effect

### 4. Timing

BEFORE Symptoms rather than AFTER Diagnosis

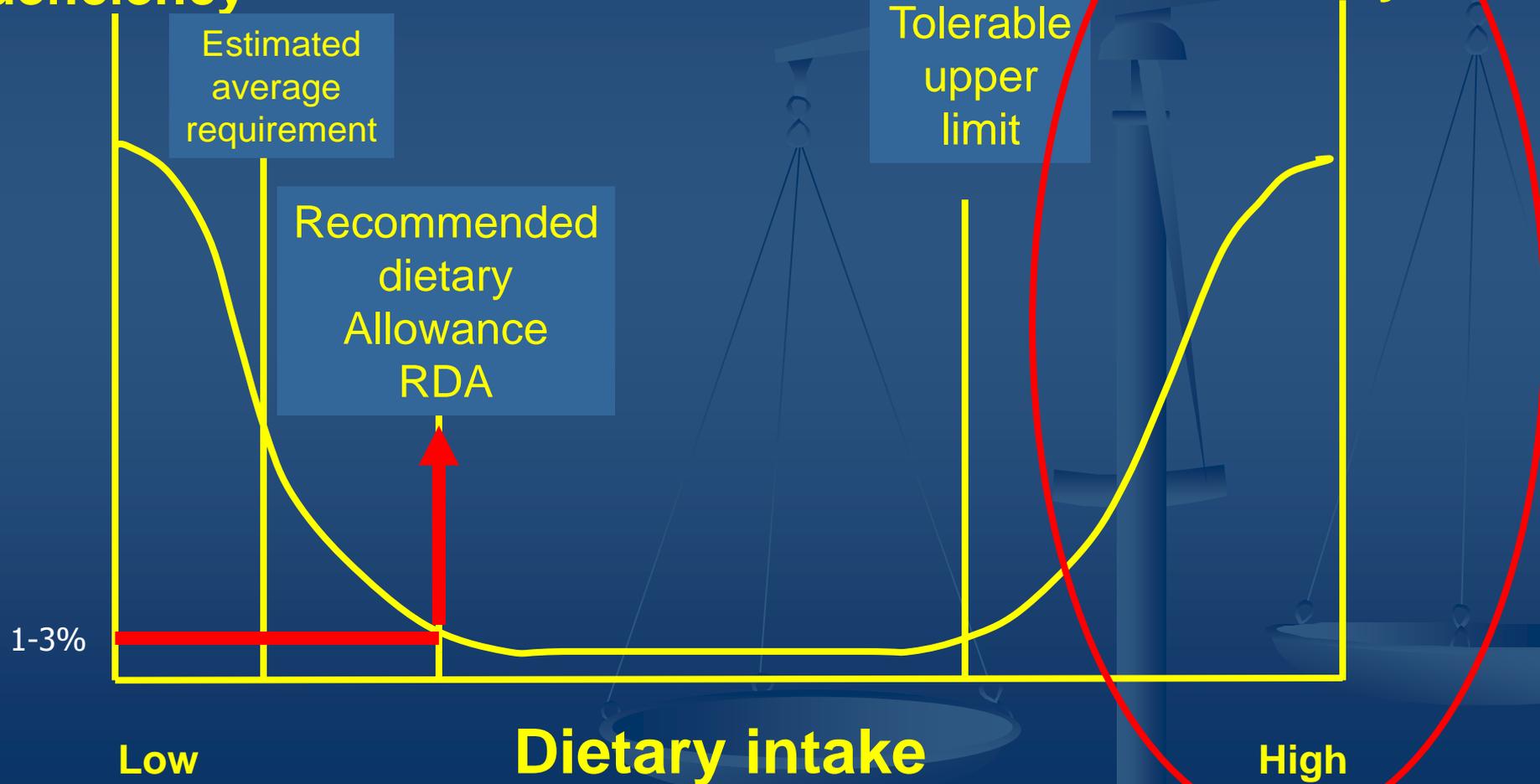
## ■ RDA = only 22.5 IU → More Studies Needed!



# Recommended Dietary Intakes

**Risk of deficiency**

**Risk of toxicity**



# Vitamin E & Parkinson's

## Is Vitamin E Toxic?

10-11-2004

### Vitamin E Linked to Higher Death Rates

By Janice Billingsley  
HealthDay Reporter

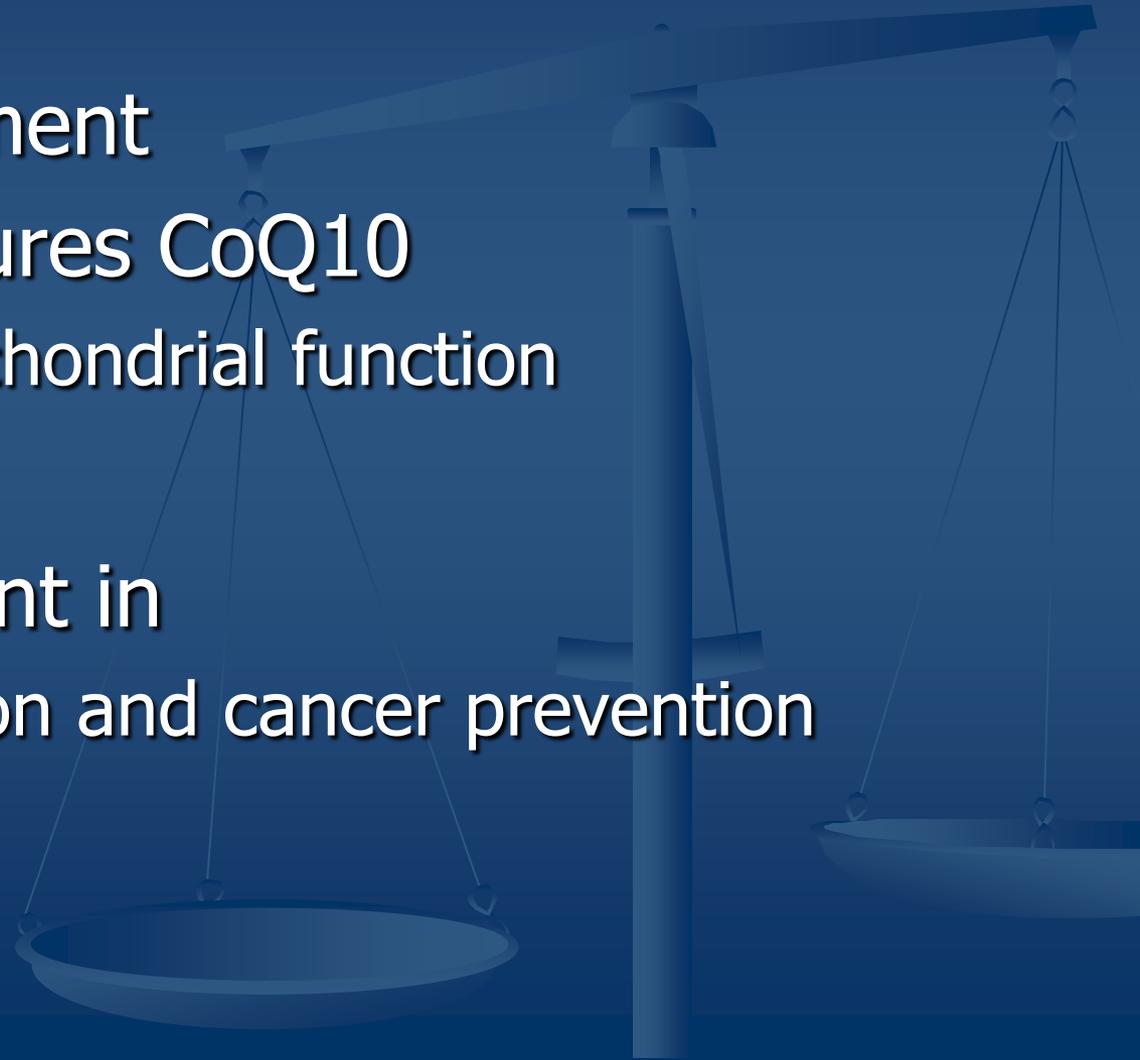
WEDNESDAY, Nov. 10 (HealthDayNews) -- High doses of the antioxidant vitamin E could increase the risk of death, Johns Hopkins researchers have found.

By re-analyzing the data from 19 vitamin E studies over the past decade, the scientists found that a daily dose of 400 IUs or more was linked to a 6 percent increased risk of death.

- Analysis of 19 studies of Vit. E
  - 139,000 participants
  - INCREASED risk of death by 4% (6% if taken with other vitamins/minerals)!!!!
- Another later study
  - 9500 participants:
  - No benefits to vit E
  - 13% higher risk of heart failure
- DATATOP study (in PD)
  - No benefit
  - No increased risk

# Coenzyme Q10

- Dietary Supplement
- Body manufactures CoQ10
  - Improves mitochondrial function
- Antioxidant
- May be important in
  - Immune function and cancer prevention



# Coenzyme Q10 & PD

ORIGINAL CONTRIBUTION

## Effects of Coenzyme Q<sub>10</sub> in Early Parkinson Disease

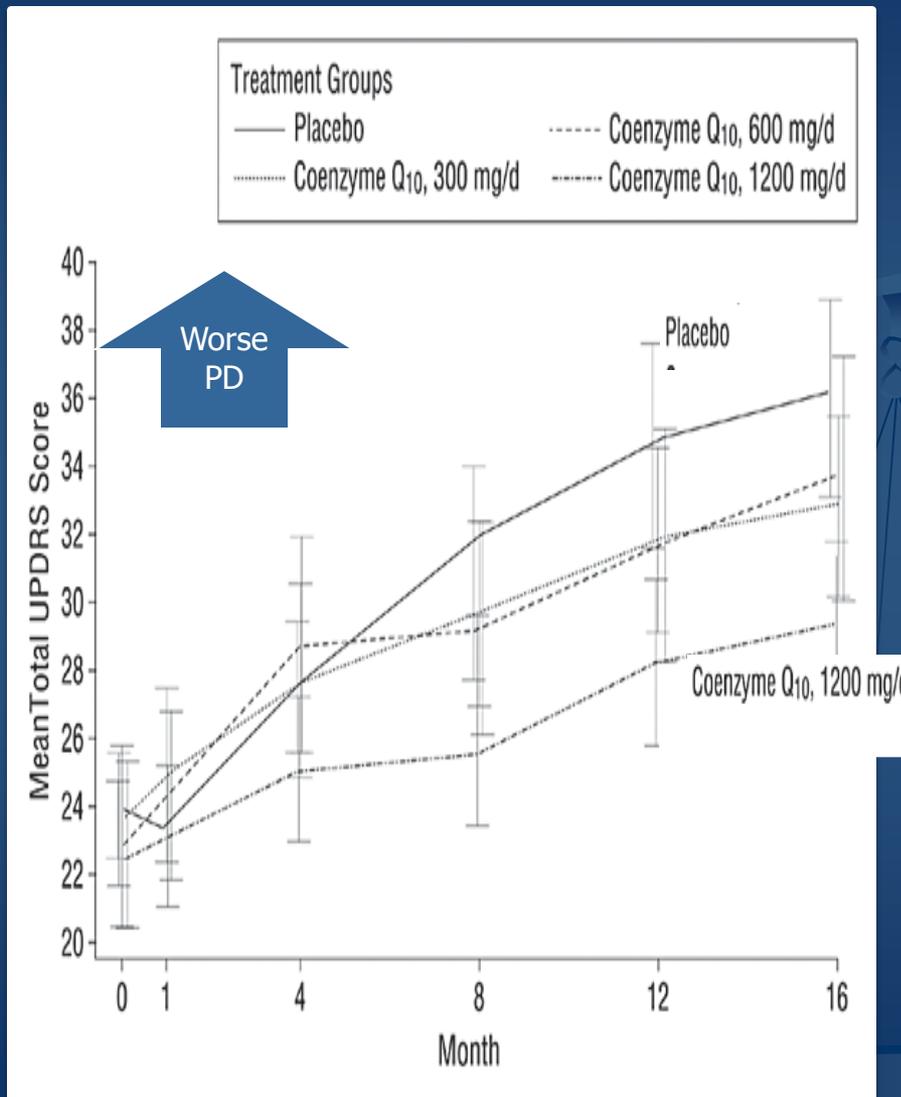
*Evidence of Slowing of the Functional Decline*

Clifford W. Shults, MD; David Oakes, PhD; Karl Kieburtz, MD; M. Flint Beal, MD; Richard Haas, MB Chir; Sandy Plumb, BS; Jorge L. Juncos, MD; John Nutt, MD; Ira Shoulson, MD; Julie Carter, RN, MS, ANP; Katie Kompoliti, MD; Joel S. Perlmutter, MD; Stephen Reich, MD; Matthew Stern, MD; Ray L. Watts, MD; Roger Kurlan, MD; Eric Molho, MD; Madaline Harrison, MD; Mark Lew, MD; and the Parkinson Study Group

Shults, C. W. et al. Arch Neurol 2002;59:1541-1550.

ARCHIVES OF  
**NEUROLOGY**

# Unified Parkinson's Disease Rating Scale (UPDRS) scores In CoQ Pilot



- 80 patients, 10 sites
- Trend in improvement, but only disability
- Larger NIH-sponsored trial (QE3)
  - Delayed due to recent data on Vit E.
  - FDA requested more safety data →
  - Recently initiated....

Shults, C. W. et al. Arch Neurol 2002;59:1541-1550.

# QE3: Effects of Coenzyme Q10 in Parkinson Disease – Phase 3

- Safety and effectiveness of high dosages of CoQ
  - Slowing clinical decline in pts w/ early PD
- 600 participants
  - 30 years of age or older
  - Dx PD w/in last 5 years
  - Not yet receiving symptomatic treatment
- Follow ups @ 4 month intervals over a 16 month period
- ~60 clinical sites in the US and Canada

Sponsor:

- National Institute of Neurological Disorders and Stroke (NINDS)

# Creatine: NET-PD Study

- 1800s - discovered
  - an organic constituent of meat
- Naturally synthesized in humans
  - ~95% total content in skeletal muscle.
- 1970s - Soviet scientists
  - May improve athletic performance
- 1990s - "natural" way to
  - Enhance athletic performance
  - Build lean body mass
  - Esp. popular among teen athletes
- Variation in response
  - carbohydrate intake, physical activity, training status, and muscle fiber type
- Creatine may reduce the effectiveness of vitamins A, D, E, and K.
- Creatine may affect liver function
  - use cautiously with potentially liver-damaging or kidney damaging herbs and supplements
- 1720 patients @ 52 centers
- Determine effectiveness for slowing clinical decline in PD
- Dx with PD within the last 5 years
- Rx'd to treat PD  $\leq$  2 years
- Estimated completion: 2014

# Dietary Factors in Parkinson's Disease: Role of Food Groups and Specific Foods

Anderson et al studied food intake and risk of PD

- No relationship to PD risk:
  - Fruits, vegetables, meats, bread and cereals
  - Foods containing vitamins A, C, E, or iron
- Vitamin use in general not related to PD risk, HOWEVER
  - Trend of increasing risk for intake of vitamin A supplements.
- Increased PD risk w/ increasing intake:
  - Foods containing animal fat
  - Vitamin D
- **CONCLUSIONS**
  - Support previous findings of no association of past intake with most food groups & PD risk
  - Confirm an increased risk of PD associated with foods containing animal fat

# Vitamin D and PD

## Vitamin D and Parkinson's Disease—A Hypothesis

Harold L. Newmark, DSc (Hon),<sup>1\*</sup> and Jonathan Newmark, MD<sup>2</sup>

<sup>1</sup>*Susan Lehman Cullman Laboratory for Cancer Research, Department of Chemical Biology, Rutgers, The State University of New Jersey, Piscataway, New Jersey, USA*

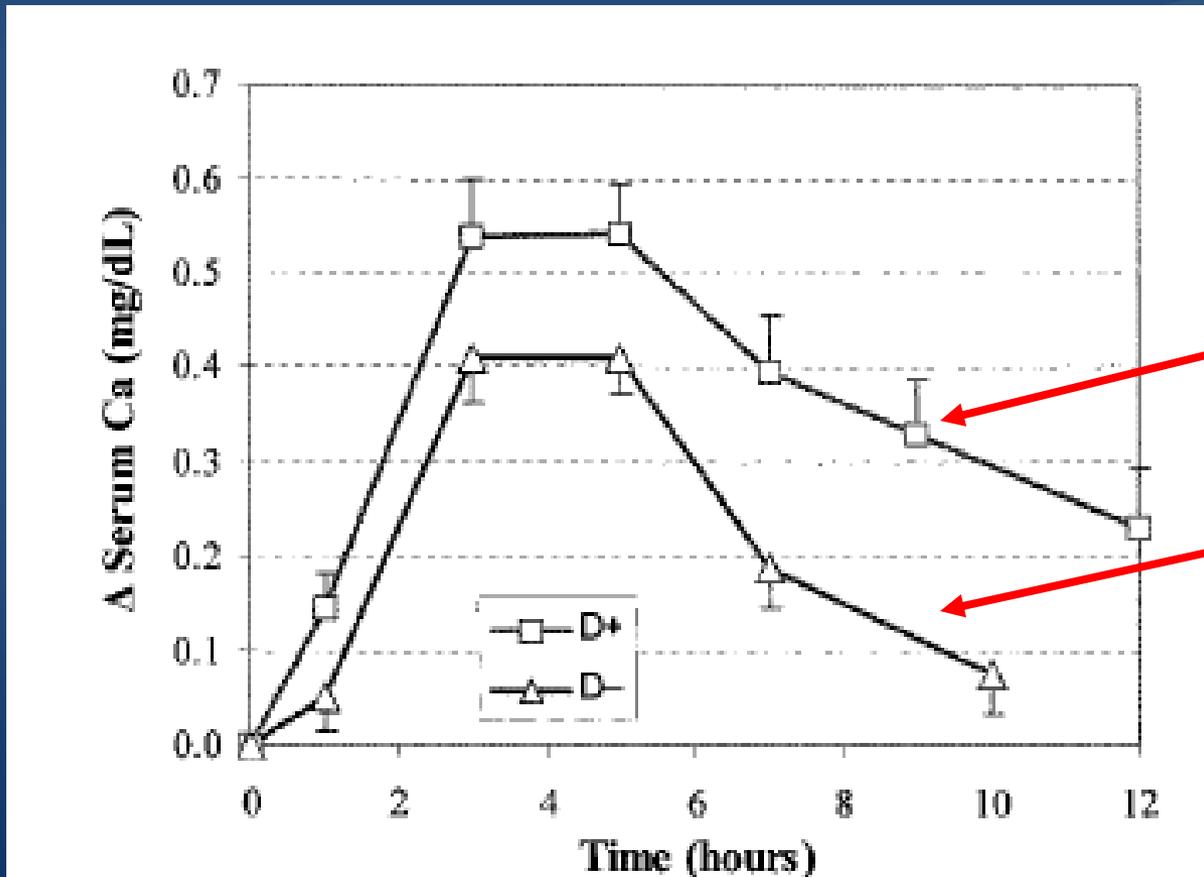
<sup>2</sup>*Deputy Joint Program Executive Officer for Medical Systems, Joint Program Executive Office for Chemical/Biological Defense, Department of Defense, Falls Church, Virginia, USA*

Movement Disorders January, 2007

Chronically inadequate vitamin D intake  
contributes to PD pathogenesis

# Vitamin D Function - Calcium Absorption

## Calcium Absorption as a function of 25-OH Vitamin D



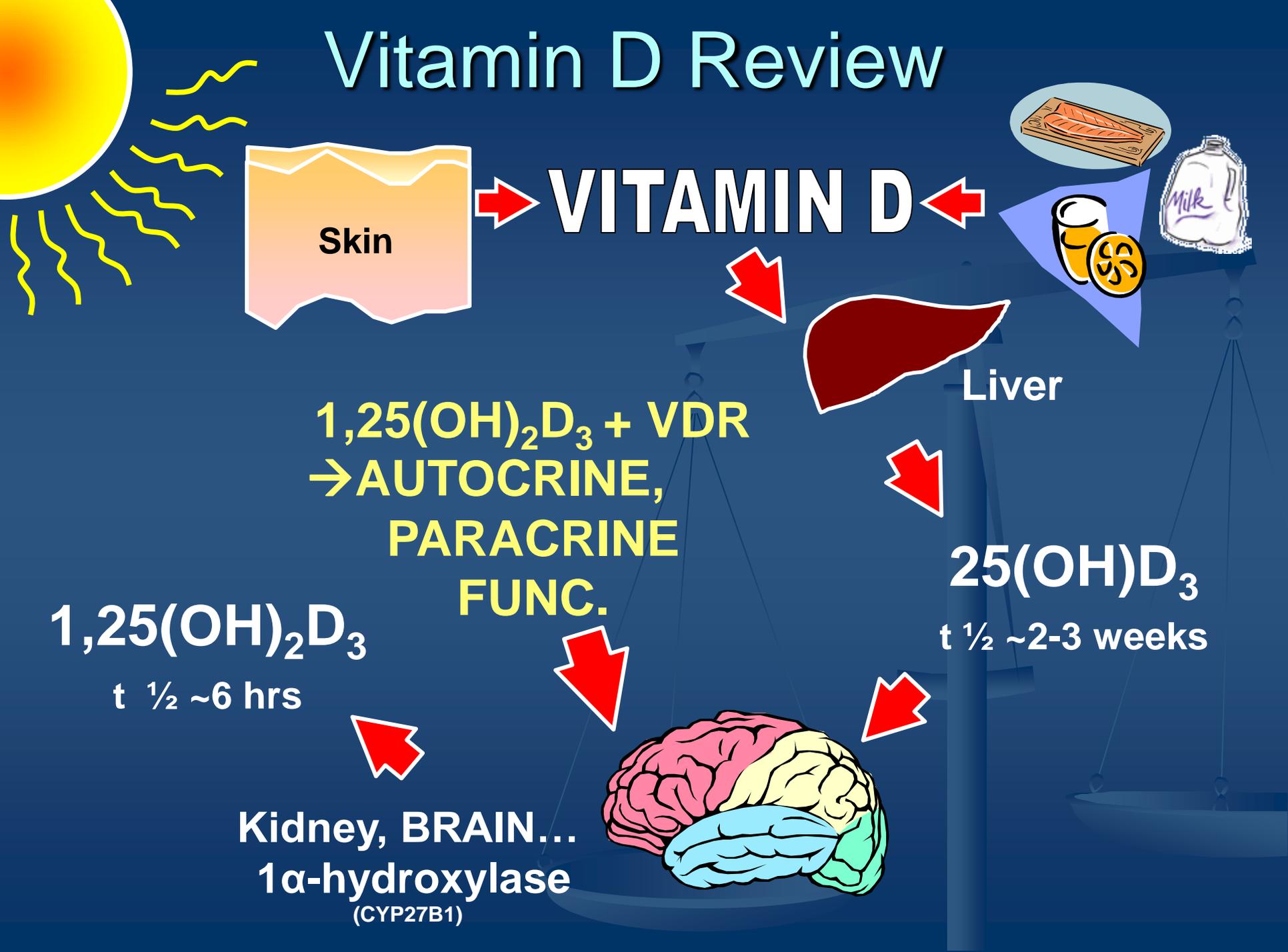
3-4 fold increase with

Normal

vs.

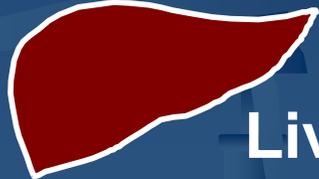
Suboptimal  
vit. D levels

# Vitamin D Review



Skin

**VITAMIN D**



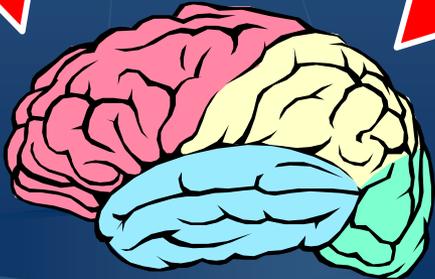
Liver

**1,25(OH)<sub>2</sub>D<sub>3</sub> + VDR  
→ AUTOCRINE,  
PARACRINE  
FUNC.**

**1,25(OH)<sub>2</sub>D<sub>3</sub>**  
t <sub>1/2</sub> ~6 hrs

**25(OH)D<sub>3</sub>**  
t <sub>1/2</sub> ~2-3 weeks

**Kidney, BRAIN...**  
**1α-hydroxylase**  
(CYP27B1)



# Vitamin D Neurobiology

Most intense immunohistochemical staining for 1 $\alpha$ -hydroxylase & vitamin D receptor

- SN, hippocampus Eyles (2005)

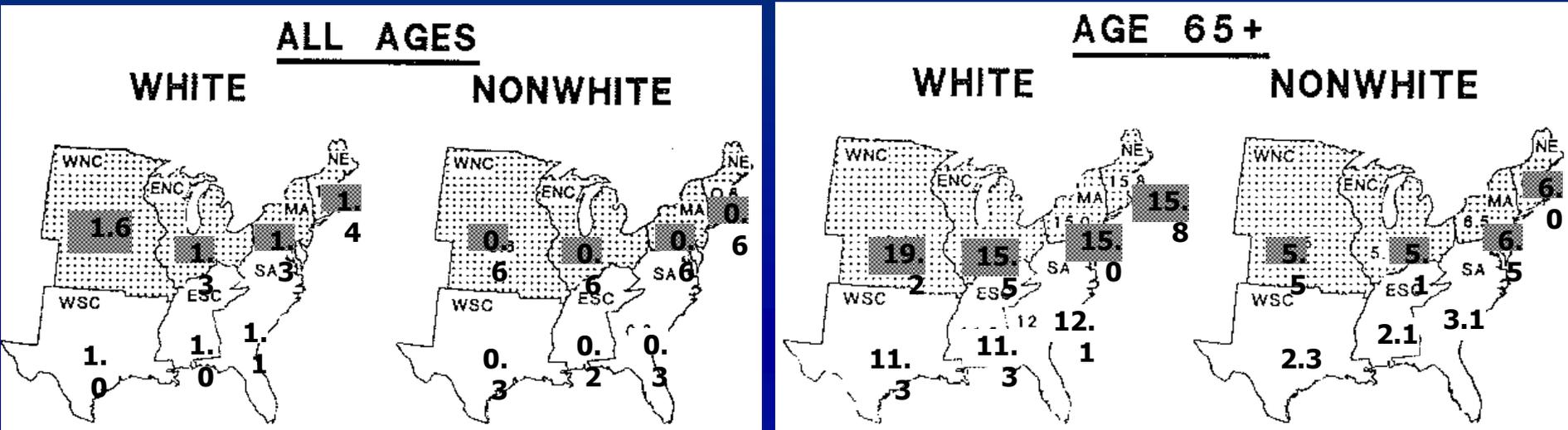
Vitamin D involved in regulation:

- Neurotrophin expression
  - GDNF, NGF, NT-3, NT-4
- Neurotransmitter synthesis
- Toxic free radical generation
- Ca<sup>++</sup> signaling/homeostasis
- Differentiation, survival of DA neurons



From Kaeluff & Tuohimaa, (2007)

# PD - Geographic Epidemiology

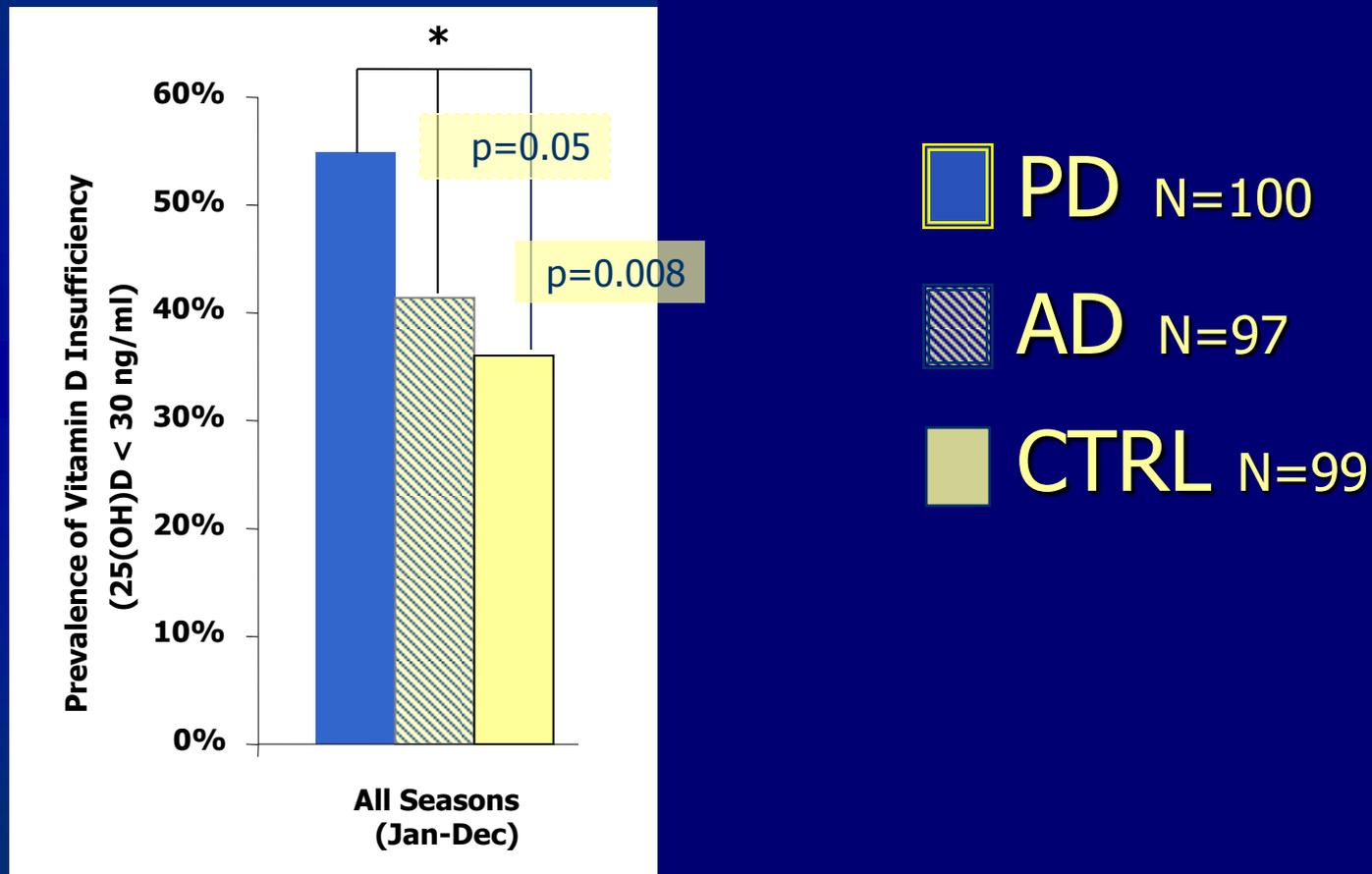


- Average age-adjusted annual death rates 1951-1961

- 9 Eastern census districts
- per 100,000 population
- by state of residence at death

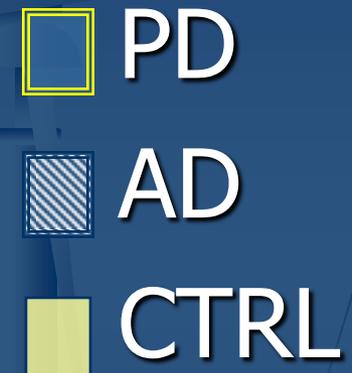
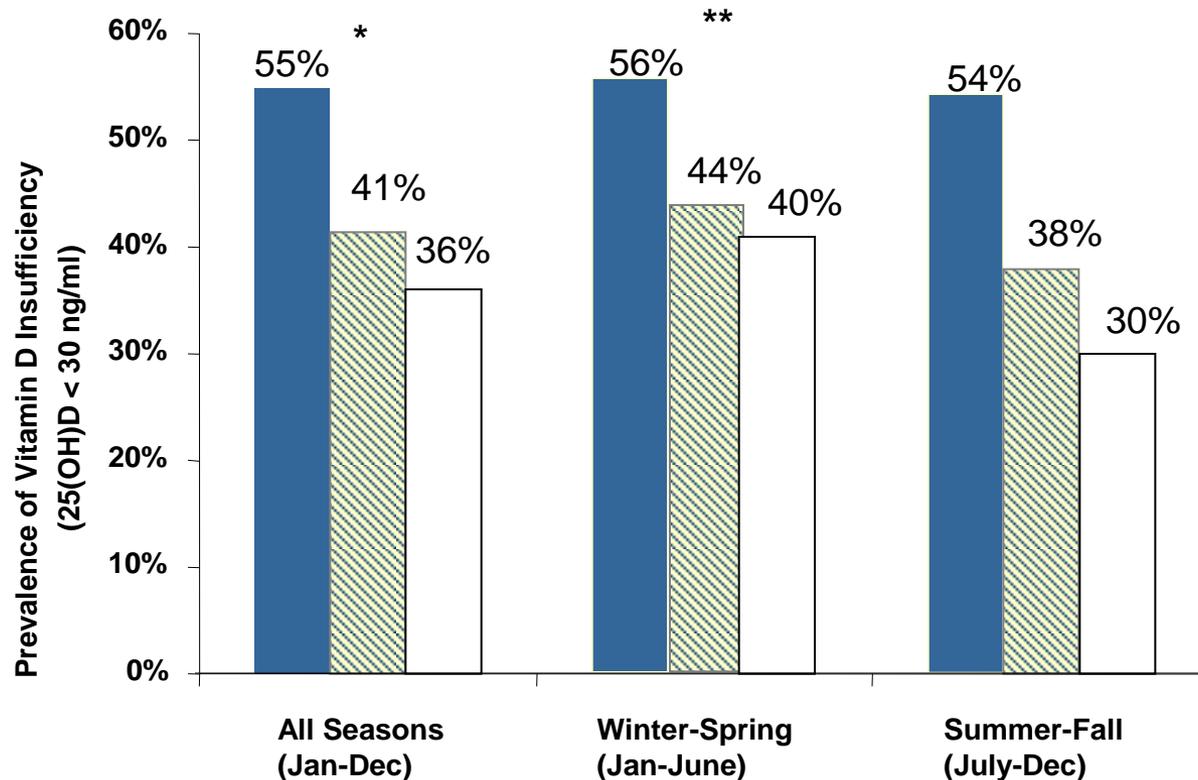
(Adaped from Kurtzke & Goldberg Neurology, 1988)

# Vitamin D in CRIN RESULTS: Prevalence of Vitamin D Insufficiency PD, AD and Healthy Control Subjects



\*ANOVA  $p = 0.03$ ; Chi-Sq  $p=0.008$  PD vs. CTRL,  $p=0.05$  PD vs. AD

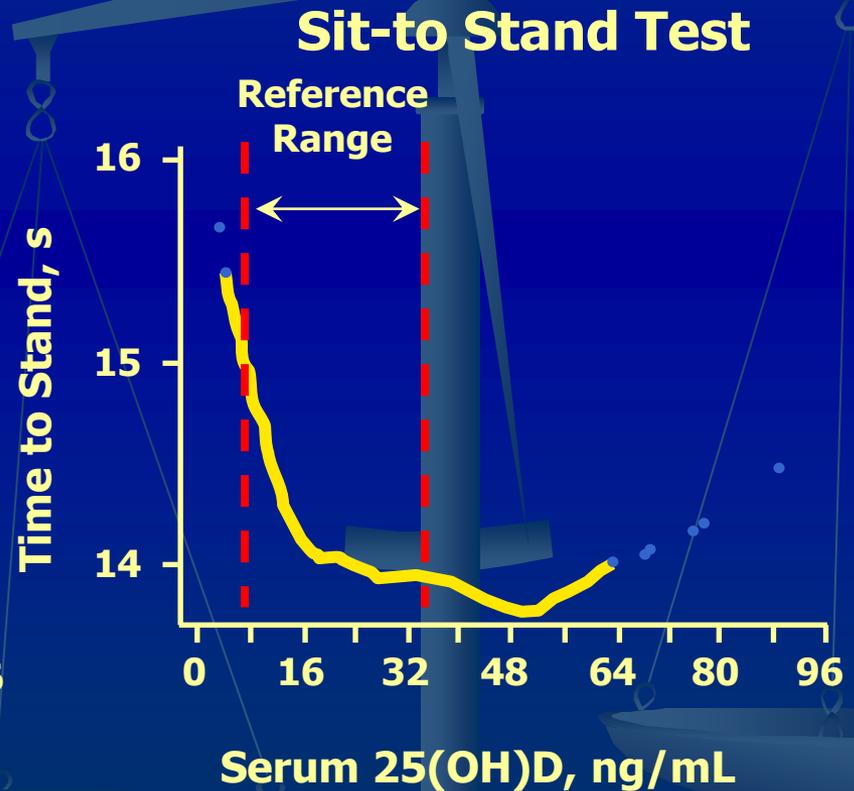
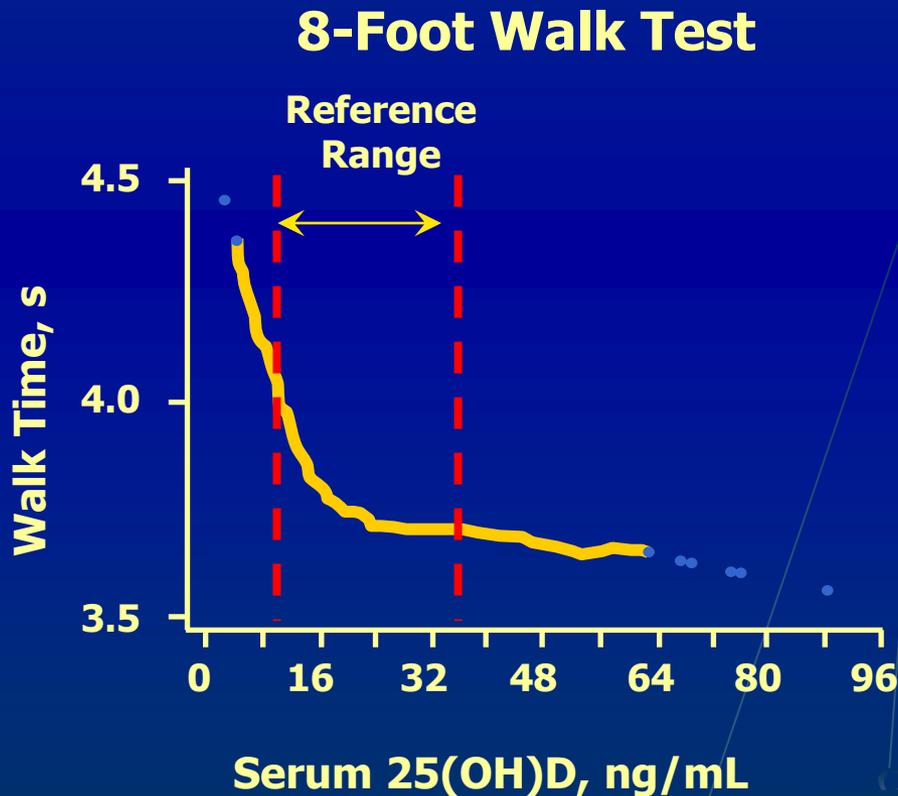
# Prevalence of Vitamin D Insufficiency (<30 ng/ml) in Subjects with PD, AD and Control



\*\*Chi-Sq  $p=0.004$  PD vs. CTRL,  $p=0.09$  vs. AD  
 $p=0.004$  PD vs. CTRL,  $p=0.17$  vs. AD

# Vitamin D Insufficiency in US Population: Impaired Function of the Lower Extremities

**NHANES III data Ambulatory persons aged  $\geq 60$  years**

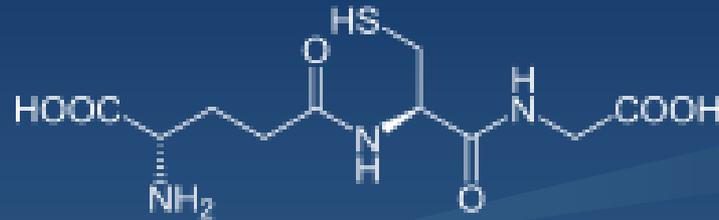


# VIDIP STUDY

## (Vitamin D in Parkinson's Disease Pilot)

- **Interventional Study Comparing Effects of 2 doses:**
  1. IOM 600 IU daily  
vs.
  1. Higher ~7700 IU daily (50K IU/wk + 600 IU/day)
- **PD patients with 25(OH)vit D <30 ng/mL**
- **UNTREATED!**
  - No history of renal disease
  - Not taking vitamin D supplements (other than Calcium/vit D combination or MVI)
  - Ambulatory during "on" state
- **Contact: Elaine Sperin, RN 404-728-4786**

# Glutathione



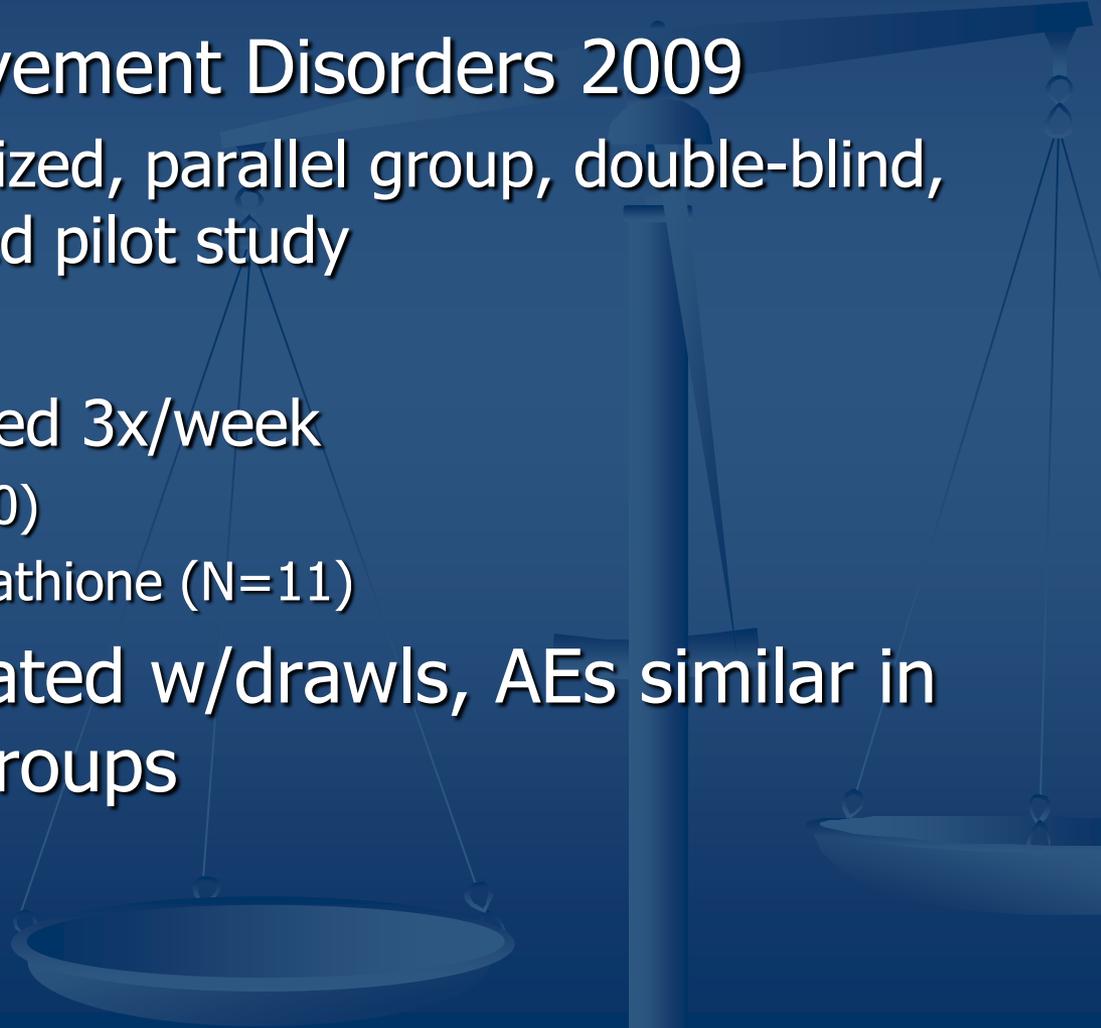
- Naturally occurring antioxidant
- Tripeptide - three amino acids
  - Cysteine, glutamic acid and glycine
- Markedly reduced in Substantia nigra early in PD (Riederer, J Neurochem 1989)
  - Reduction correlates with disease severity
- Not sure if crosses blood-brain barrier

# Glutathione

- Single clinical trial of 9 patients in Italy
  - Open Label
    - PLACEBO EFFECT CAN BE BIG IN PD!!!
  - Twice daily infusion for 30 days
  - Improved patients PD rating scales
    - Comparable to levodopa
    - Benefit lapsed over 2-4 months
    - 2 patients had thrombophlebitis at the infusion site



# Glutathione & PD: Blinded Pilot Study

- Hauser, et al Movement Disorders 2009
    - 12-week randomized, parallel group, double-blind, placebo-controlled pilot study
    - 21 patients
    - Randomly assigned 3x/week
      - IV Placebo (N=10)
      - 1400 mg IV Glutathione (N=11)
  - No treatment-related w/drawls, AEs similar in both treatment groups
- 

# Glutathione & PD: Blinded Pilot Study

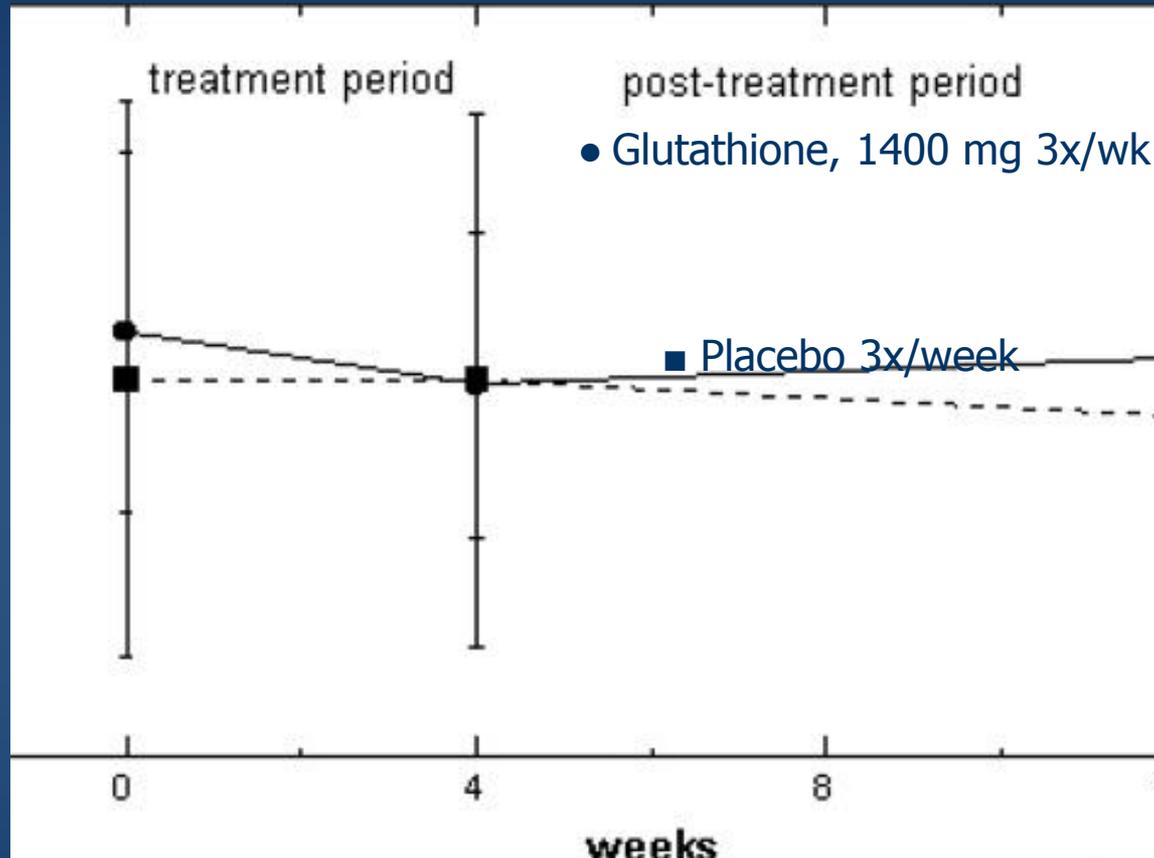


Figure 2 from Hauser, 2009: UPDRS II (ADL sub-score) during and post-treatment (glutathione or placebo)

# Vitamin and Dietary Supplements in PD

- ✓ What are vitamins and Dietary supplements?
- ✓ Specific vitamins/supplements in PD
- **Practical Issues**





# Weight Loss & PD

- In prospective study (Chen, et al 2003)
  - Begins ~2-4 years pre-diagnosis
  - Despite increased energy intake
- Reasons
  - Despite decreased smell, NO decreased intake
  - Increased activity (tremors, dyskinesia, rigidity)
  - Trouble swallowing

# Swallowing & PD

- COMMON!

Poltulska - 18 PD patients & 22 non-PD control subjects

- Mild PD severity (average H&Y score 2.1)
- 13/18 complained of dysphagia
- 18/18 had some abnormalities on videofluoroscopic study

# Diet and PD Medications

- Levodopa = Amino acid (AA)
  - Protein from food broken down to AA's
- AA's from food (protein) may compete
- "Protein Redistribution Diet"
  - NOT Low Protein Diet!!!!
  - 0.5 - 0.8 g/kg ideal body weight
    - ~40-60 g protein per day
- 1991 Berry et al studied 9 patients
  - 5:1 'Balanced' Carbohydrate:protein diet
  - Motor performance better



# Vitamin and Dietary Supplements in PD

- ✓ What are vitamins and Dietary supplements?
- ✓ Specific vitamins/supplements in PD
- ✓ Weight loss, diet
  - What's the take home message?



# What's the Take Home Message?

- Specific vitamins/supplements in PD
  - Vitamin C - no suggestion of benefit, other than w/ high dose E
  - Vitamin E - theoretically may help, but
    - Disappointing in clinical trials
    - ? Toxicity – none seen in DATATOP
- HOWEVER...
  - RDA = only 22.5 IU!
  - More Studies Needed!

## Vitamin E Trials 'Fatally Flawed'

*ScienceDaily (Sep. 26, 2007)* — Generations of studies on vitamin E may be largely meaningless, scientists say, because new research has demonstrated that the levels of this micronutrient necessary to reduce oxidative stress are far higher than those that have been commonly used in clinical trials.

In a new study and commentary in *Free Radical Biology and Medicine*, researchers concluded that the levels of vitamin E necessary to reduce oxidative stress – as measured by accepted biomarkers of lipid peroxidation – are about 1,600 to 3,200 I.U. daily, or four to eight times higher than those used in almost all past clinical trials.

This could help explain the inconsistent results of many vitamin E trials for its value in preventing or treating cardiovascular disease, said Balz Frei, professor and director of the Linus Pauling Institute at Oregon State University, and co-author of the

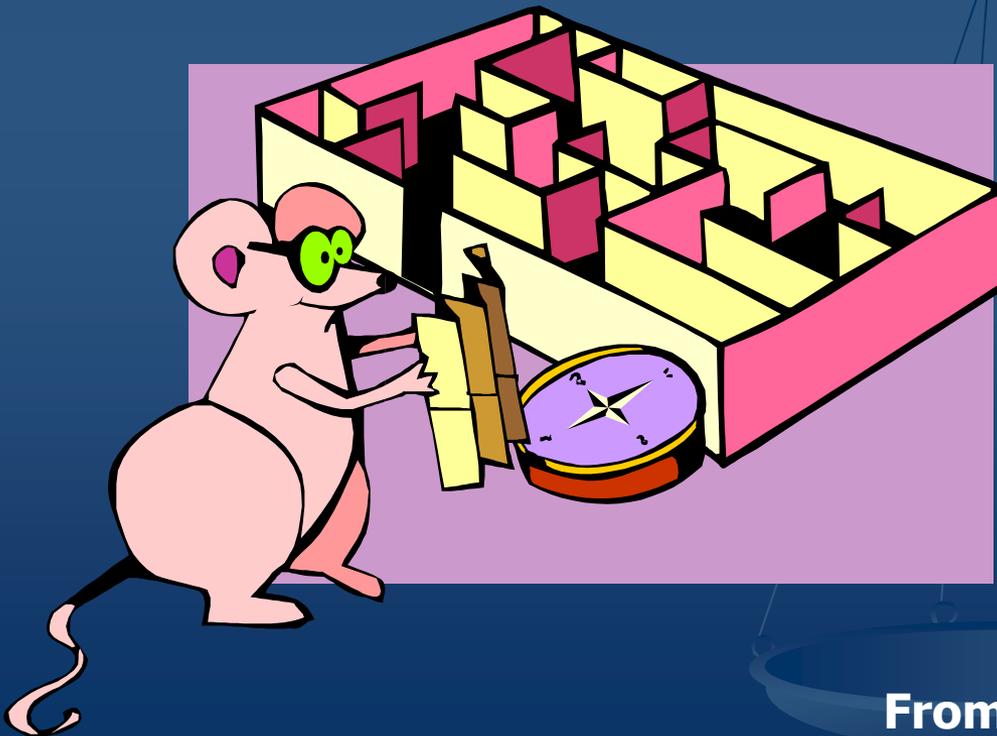
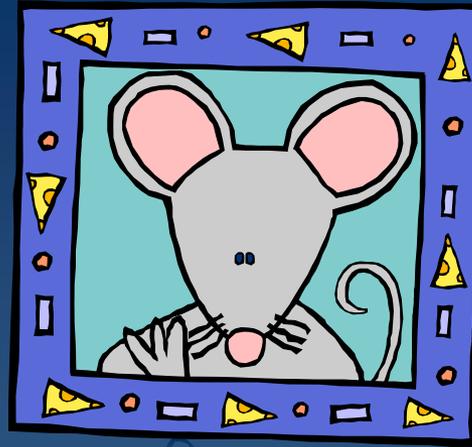
new commentary along with Jeffrey Blumberg, at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University.

# What's the Take Home Message?

- Specific vitamins/supplements in PD
  - Vitamin C - no suggestion of benefit, other than w/ high dose E
  - Vitamin E - theoretically may help, but
    - Disappointing in clinical trials
    - ? Toxicity – none seen in DATATOP
  - Coenzyme Q10
    - Pilot study promising – QE3 underway
    - Appears quite safe
  - Vitamin D
    - Intriguing, but definitely more research needed
  - Glutathione
    - No known toxicity
    - Awaiting results of studies



*"Vitamin trouble,"  
Stuart replied.  
"She took vitamin  
D when she  
needed A."*



*"She took vitamin B  
when she was short of  
C, and her system  
became overloaded  
with riboflavin,  
thiamine  
hydrochloride, and  
pyridoxine, the need  
for which in human  
nutrition has not yet  
been established." –*

**From *Stuart Little*, by E.B. White (1945)**

# What's the Take Home Message?

- Dietary Supplements, including Vitamins are NOT regulated like Rx or OTC Meds!
- Can have drug interactions & toxicities!
- While many have theoretical uses for PD
  - No Proof yet
- Balanced diet is most important!





*Thank You!*