

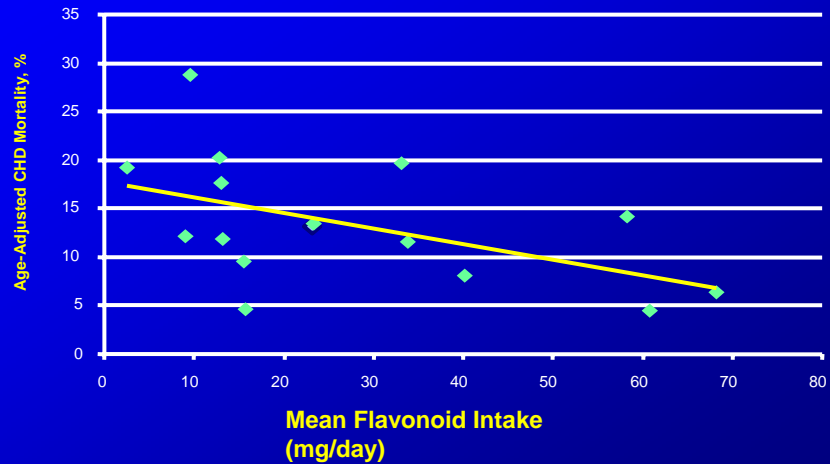
Numerous epidemiology studies support the concept that diets rich in plant foods are associated with a reduced risk for vascular disease.

Fruits/Vegetables

- **Multivariate adjusted* RR for ≥ 3 times/day vs. < 1 time/day**
 - Ischemic heart disease mortality
RR=0.76 (95% CI: 0.56, 1.03)
 - CVD mortality
RR=0.73 (95% CI: 0.58, 0.92)
 - All cause mortality
RR=0.85 (95% CI: 0.72, 1.00)

*adjusted for age, sex, race, energy, physical activity, alcohol consumption, smoking, plus others

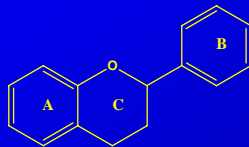
Numerous epidemiology studies support the concept that diets rich in plant foods are associated with a reduced risk for vascular disease.



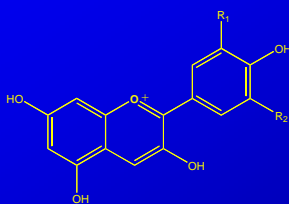
Hertog et al., *Arch Intern Med*, 1995;155: 381-6

Flavonoids

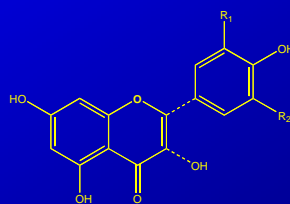
- C₁₅ (C₆-C₃-C₆) basic skeleton



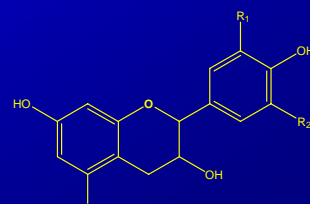
- 3 most common classes



Anthocyanins



Flavonols



Flavan-3-ols

Flavanol Profiles

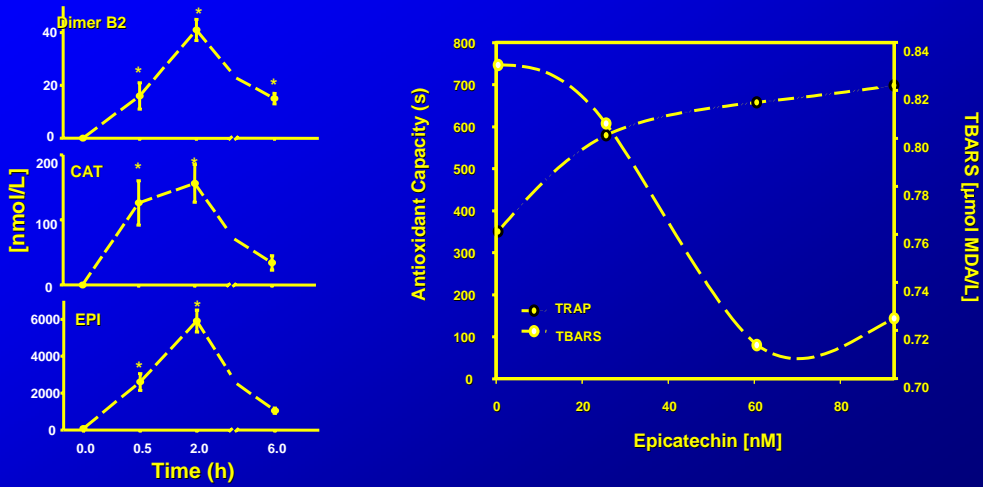
- **Cocoa and Chocolate**
 - B-type procyanidins
- **Cranberries**
 - A- and B-type procyanidins
 - few monomers
- **Peanuts**
 - A- and B-type procyanidins
 - few monomers
- **Tea**
 - Procyanidins and Prodelphinidins
 - few oligomers
- **Apple**
 - B-type procyanidins
- **Blueberries**
 - B-type procyanidins
- **Almond**
 - B-type procyanidins
- **Wine**
 - B-type procyanidins
- **Grape Seeds**
 - B-type procyanidins
 - Galloylated

Lazarus et al., J. Ag. Food Chem., 47, 3693-3701

Can common foods provide significant amounts of flavonoids?

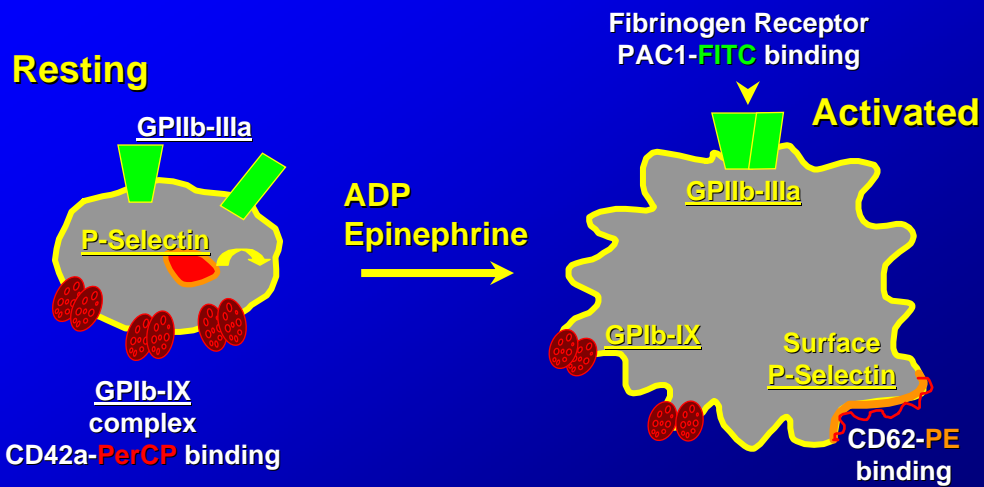
- Healthy volunteers, 25-56 y.
- Asked to refrain from taking vitamin supplements, and food rich in flavonoids for 24 h, and fasted overnight.
- Subjects ingested a flavonoid-rich chocolate food (0, 35, 70, and 105 g) and bread.
- Blood was drawn at 0 h, 2 h and 6 h.
- The chocolate contained 1.3 mg/g of epicatechin and 5.3 mg/g of total procyanidins.

Plasma Concentrations of Cocoa Flavanols and Dimeric Procyanidins After Consuming 0.375 g/kg of Cocoa



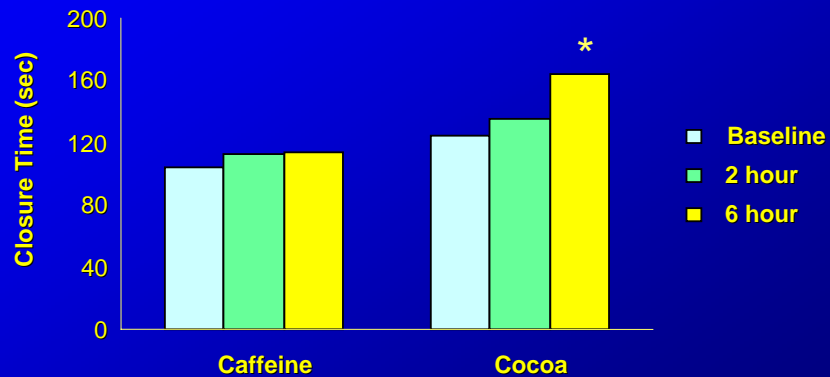
Holt et al. *AJCN* 2002; 76: 798

Platelet Activation



Flavonoids: Platelet Reactivity

Consumption of cocoa beverage increases closure time (time to clot)



Rein et al. *AJCN* 72: 30-35, 2000

Wine, Grape Products, and Cocoa Reduce Platelet Function



Pelligrini et al., 1996
Pace-Asciak et al., 1996
Rein et al., 2000

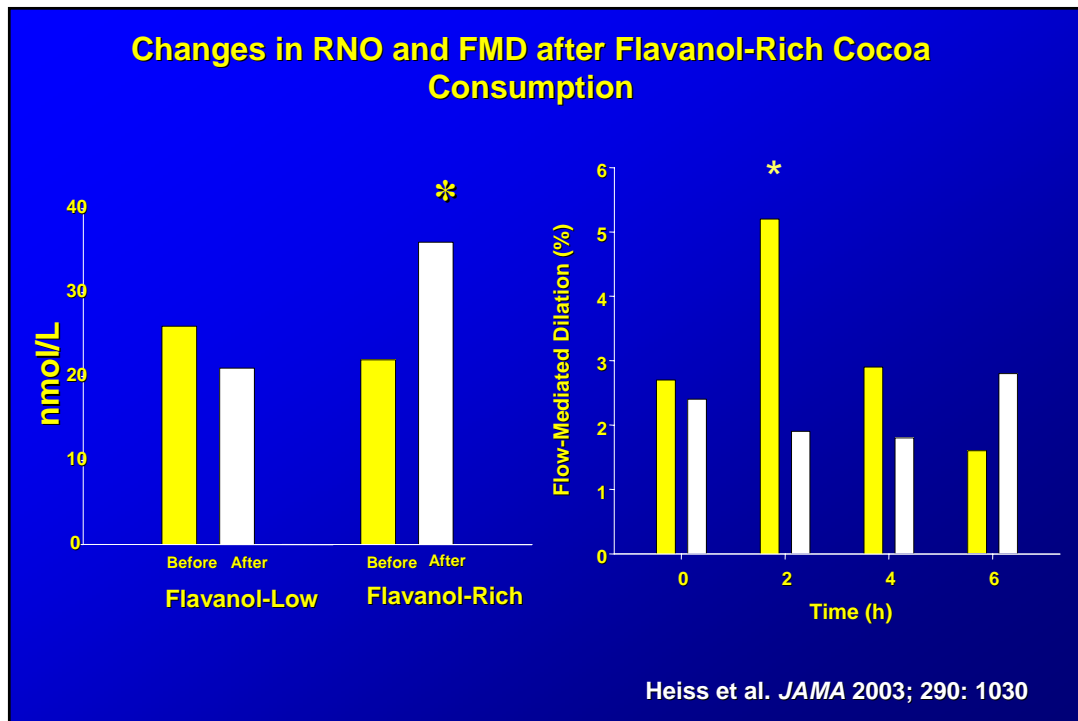


Osman et al., 1998
Keevil et al., 2000
Freedman et al., 2001

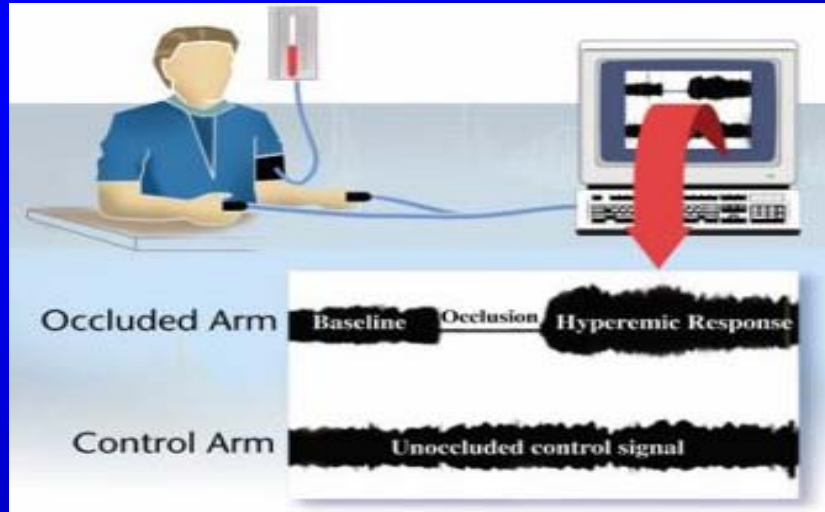


Rein et al., 2000
Pearson et al., 2002
Holt et al., 2002
Murphy et al., 2003
Innes et al., 2003

Endothelium Dependent Vasorelaxing Activity of Flavanols



Peripheral Arterial Tone (PAT)

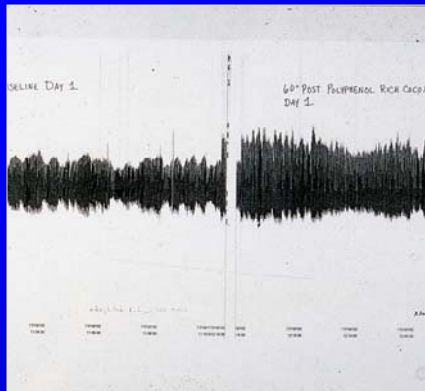


Itamar Medical Foundation; Caesarea, Israel)

Day 1

Baseline

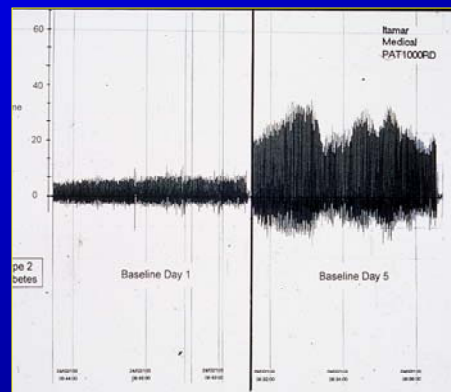
Post Cocoa



Day 5

Baseline

Post Cocoa



Fisher et al., *J Hypertens* 21: 2281-2286, 2003

Wine, Grape Products, and Cocoa and Chocolate Enhances Endothelial Function *in vitro* and *in vivo*



Fitzpatrick et al., 1993, 2000
Cishek et al., 1997
Adriambelosan et al., 1997
Agewall et al., 2000
Hashimoto et al., 2001
Stein et al., 1999



Karim et al., 2000
Engler et al., 2002, 2004
Rein et al., 2000
Heiss et al., 2003

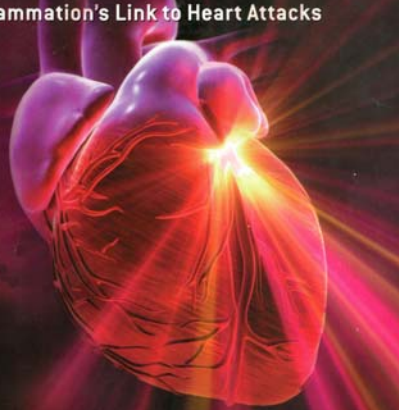
PLUTO AND BEYOND • THE SKEPTICAL ENVIRONMENTALIST REPLIES

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MAY 2002
WWW.SCIAM.COM

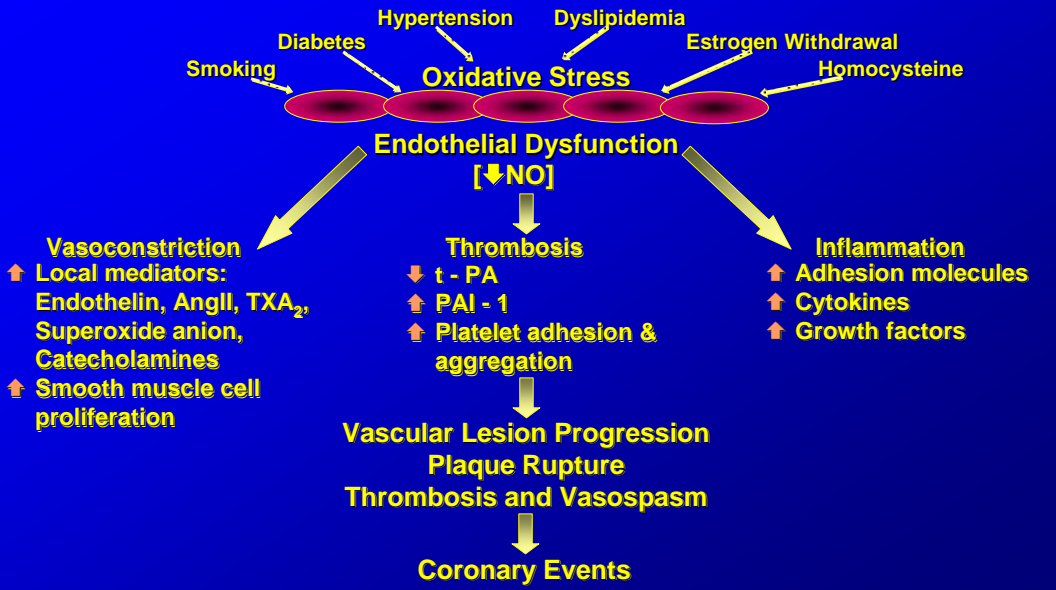
A FIRE WITHIN

Inflammation's Link to Heart Attacks



Pathogenesis of Atherothrombotic Disease

Risk Factors



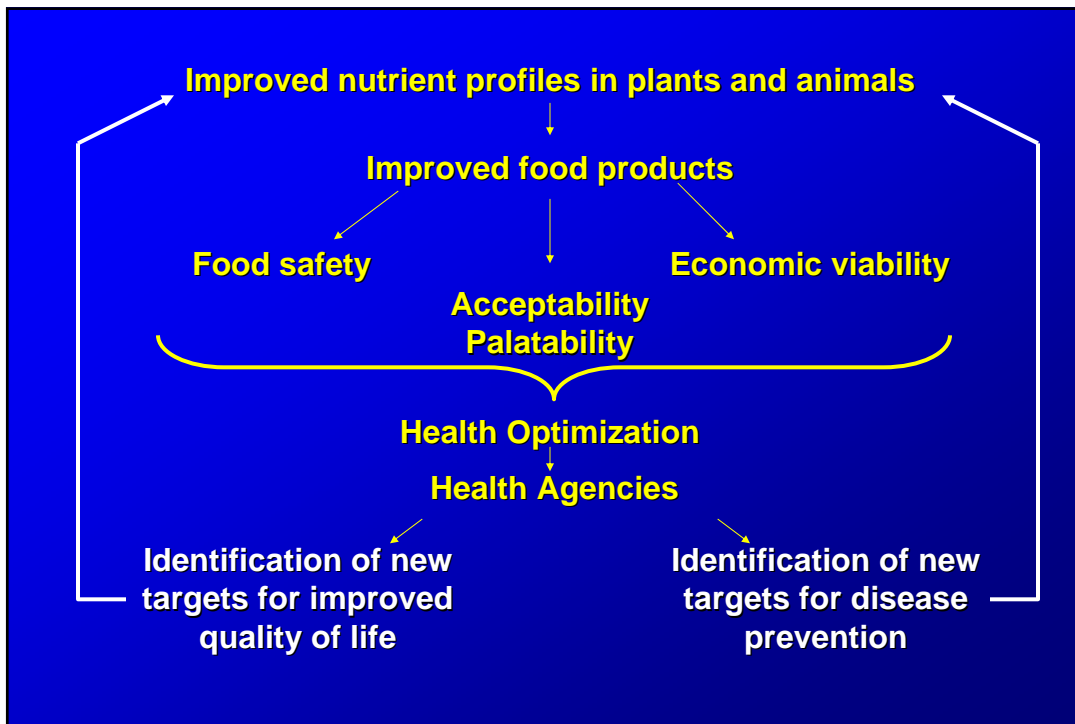
Changes in food processing
and food storage

Changes in
agricultural practices

Improved nutrient profiles in plants
and animals

Conventional
genetics

GMO



Risk-Benefit Analysis

Potential Health Impacts of Excessive Flavonoid Intake

“...the fetus may be exposed to high circulating levels of flavonoids, which may elicit toxic responses that may otherwise be innocuous to the mother.”

Skibola & Smith, Free Radic Biol Med, 29: 375-83, 2000

...“Perhaps pregnant women should restrict their intake of fruits” Paul Harvey, 2003

Who do we protect ?

Will future legislation require food industries to educate susceptible populations on the putative “risks”, as well as the putative “benefits”, of modified foods ?

Will the expectation be that “foods” are optimized for the “general” population (eg non-smokers; non-pregnant women), or that they be optimized for “susceptible” populations (eg smokers; pregnant women) ?

Adversity presents danger, as well as opportunity.

The “omics” revolution provides a path through which food can be tailored to significantly enhance health. The above requires the teams with diverse backgrounds, and a education program that targets the public, as well as regulatory and government officials.

Nutrition education programs that ignore the concept of risk-benefit set the stage for public confusion and anger at the food industry. However, education programs that include this concept will result in more realistic expectations of what food can provide to the “individual”, the family and the general population.