International Alliance of Dietary and
Food Supplement Associations
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The Impact of Nutrition on Aspects of Healthy Aging

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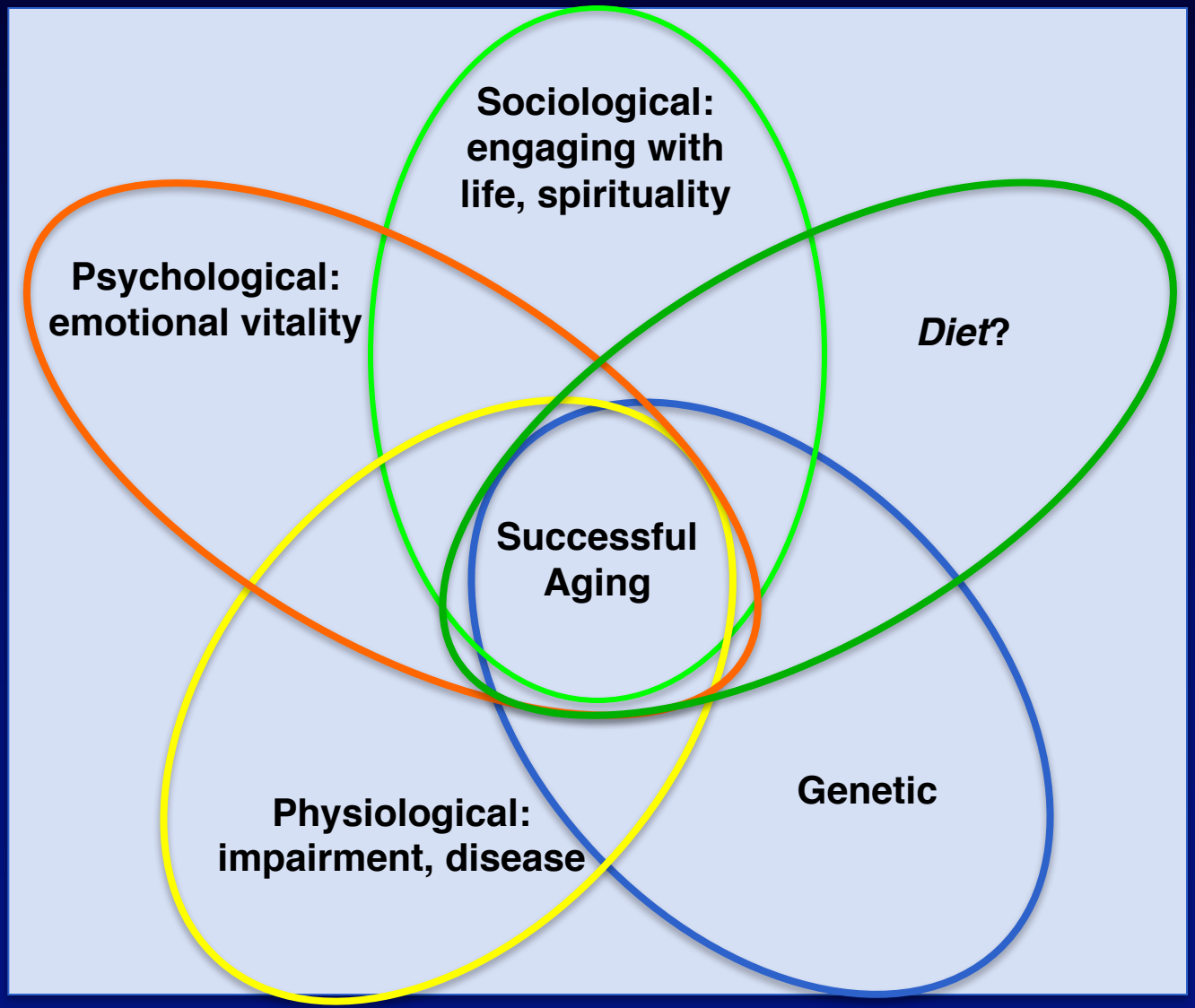
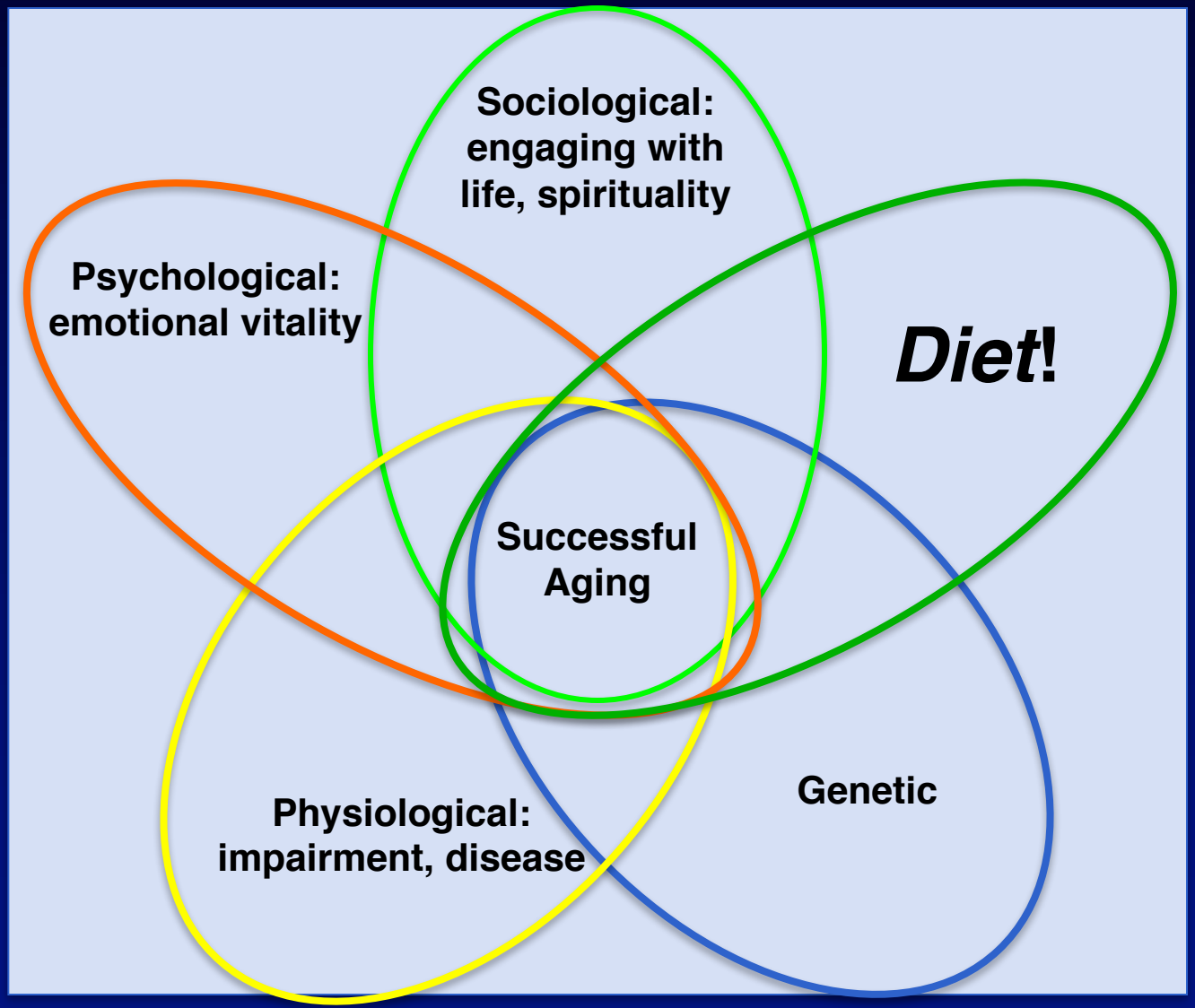
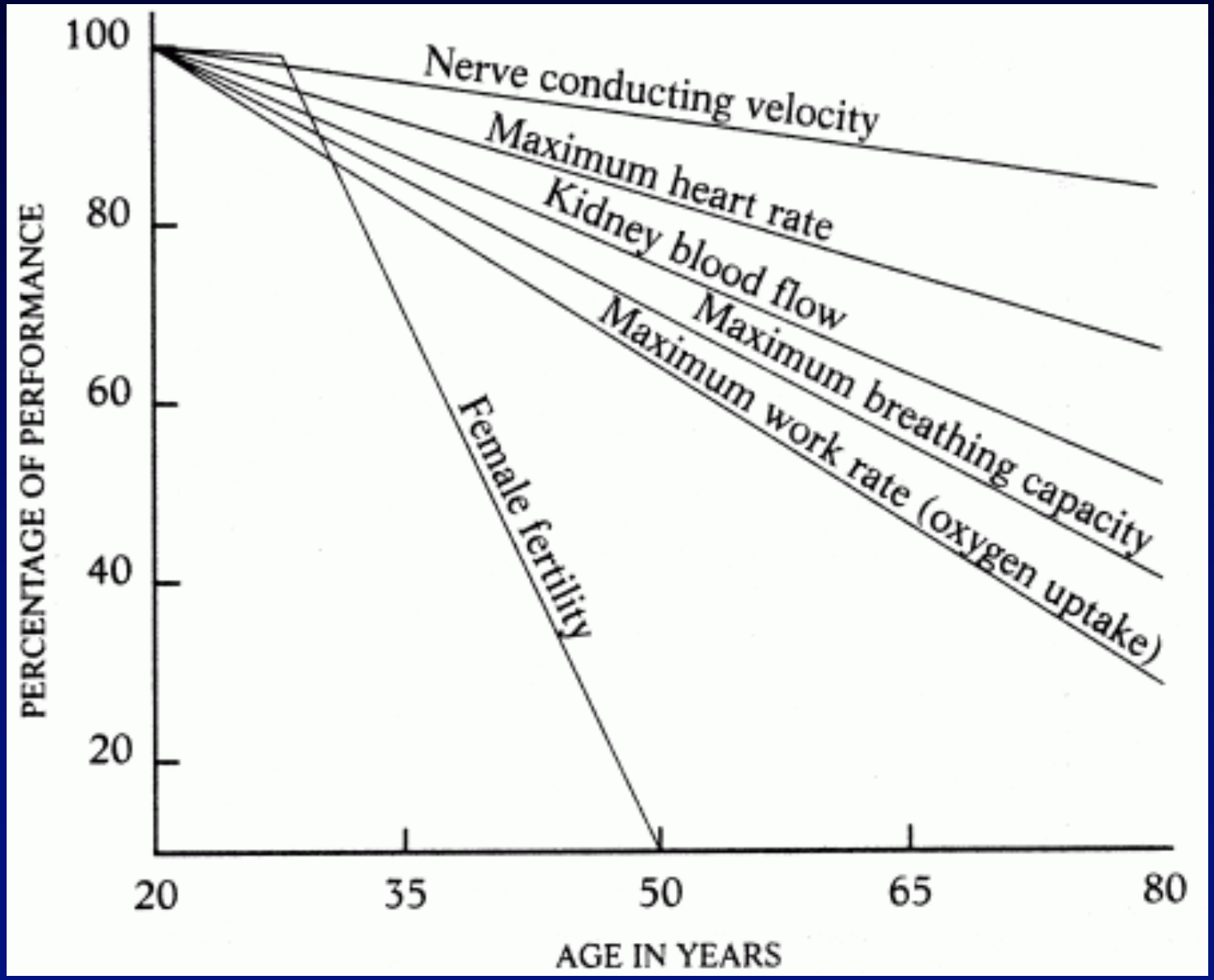
Successful Aging



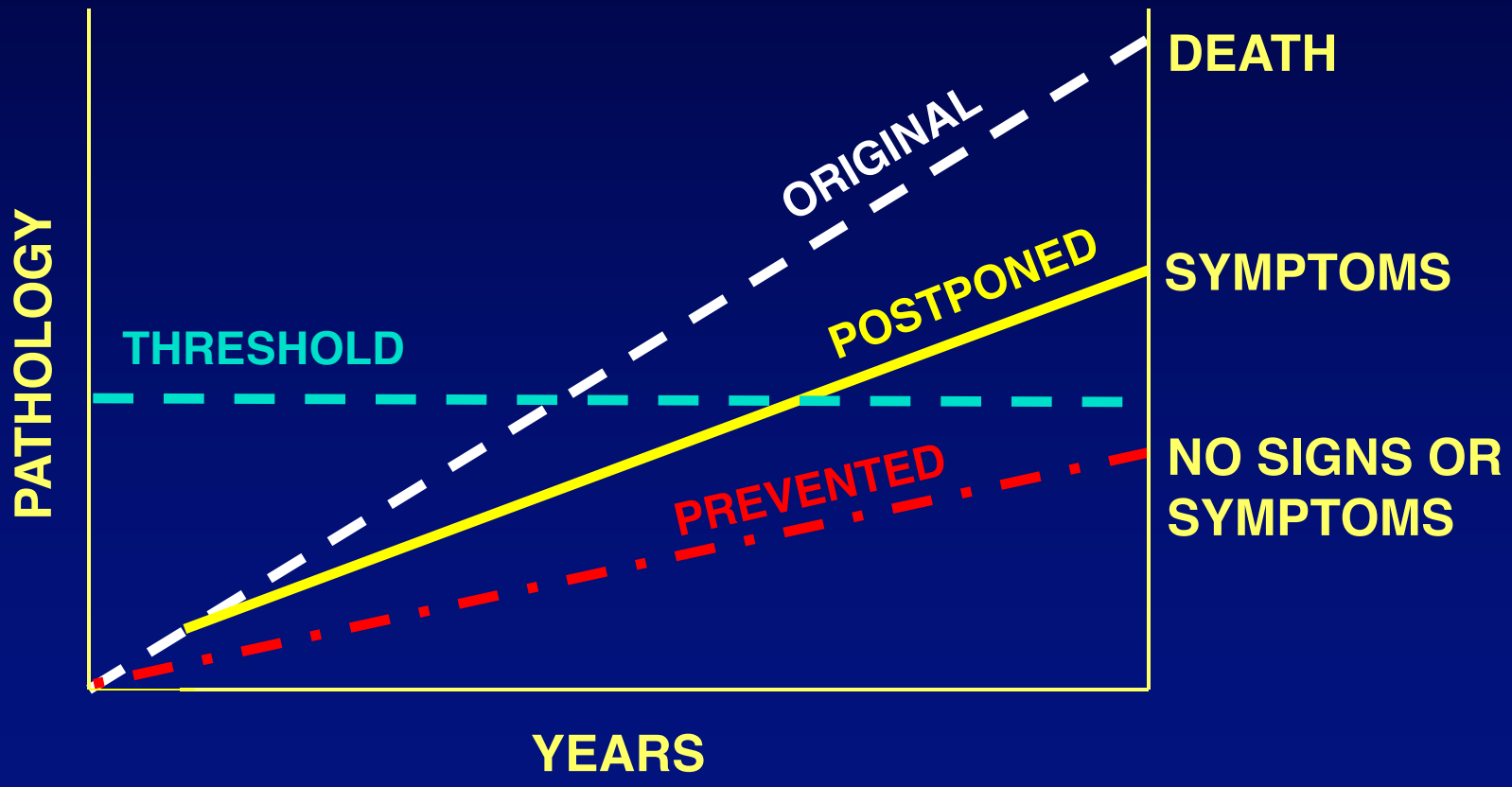
Successful Aging



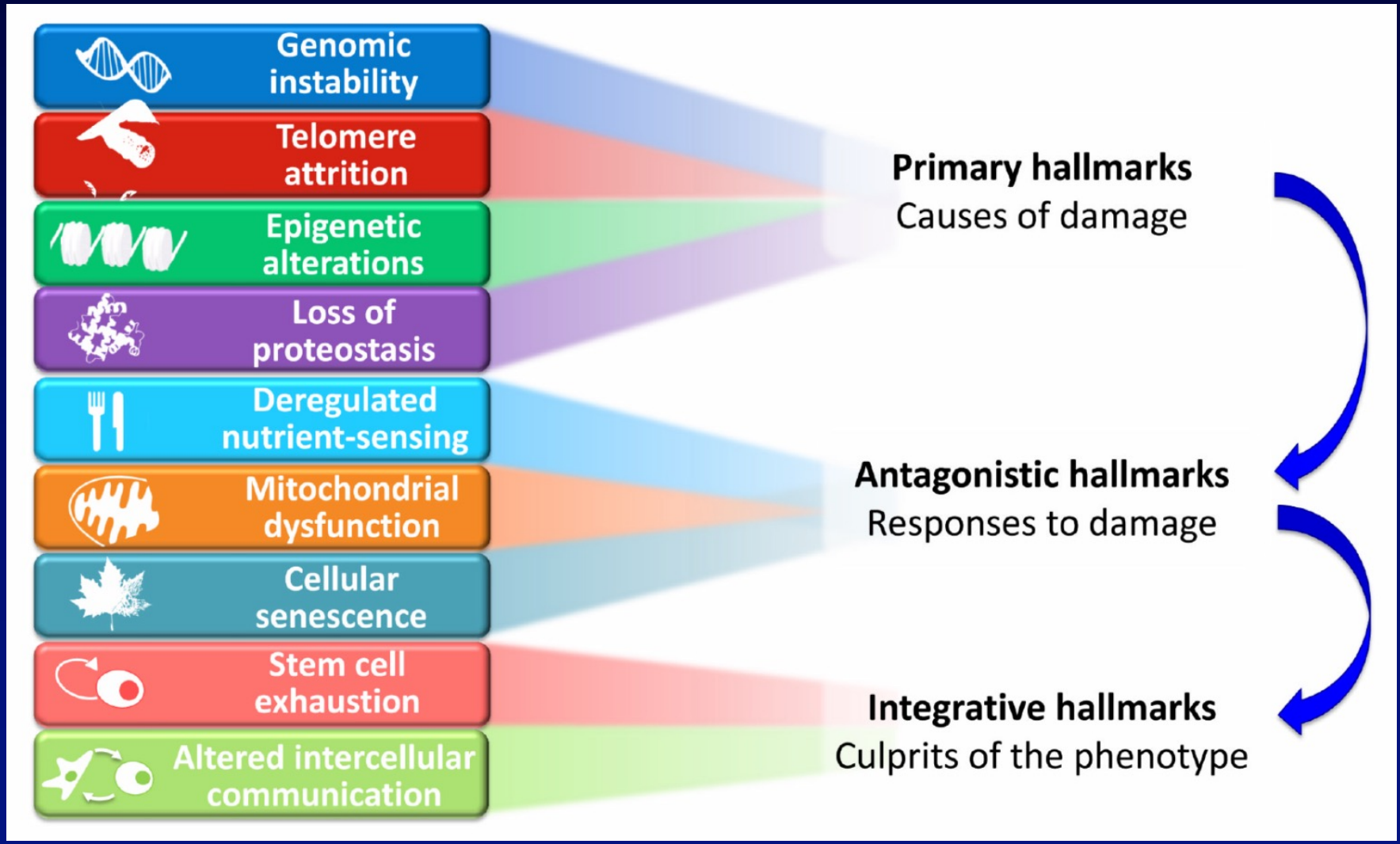
Age-related Declines in Physiological Function



Preventive Nutrition and Aging

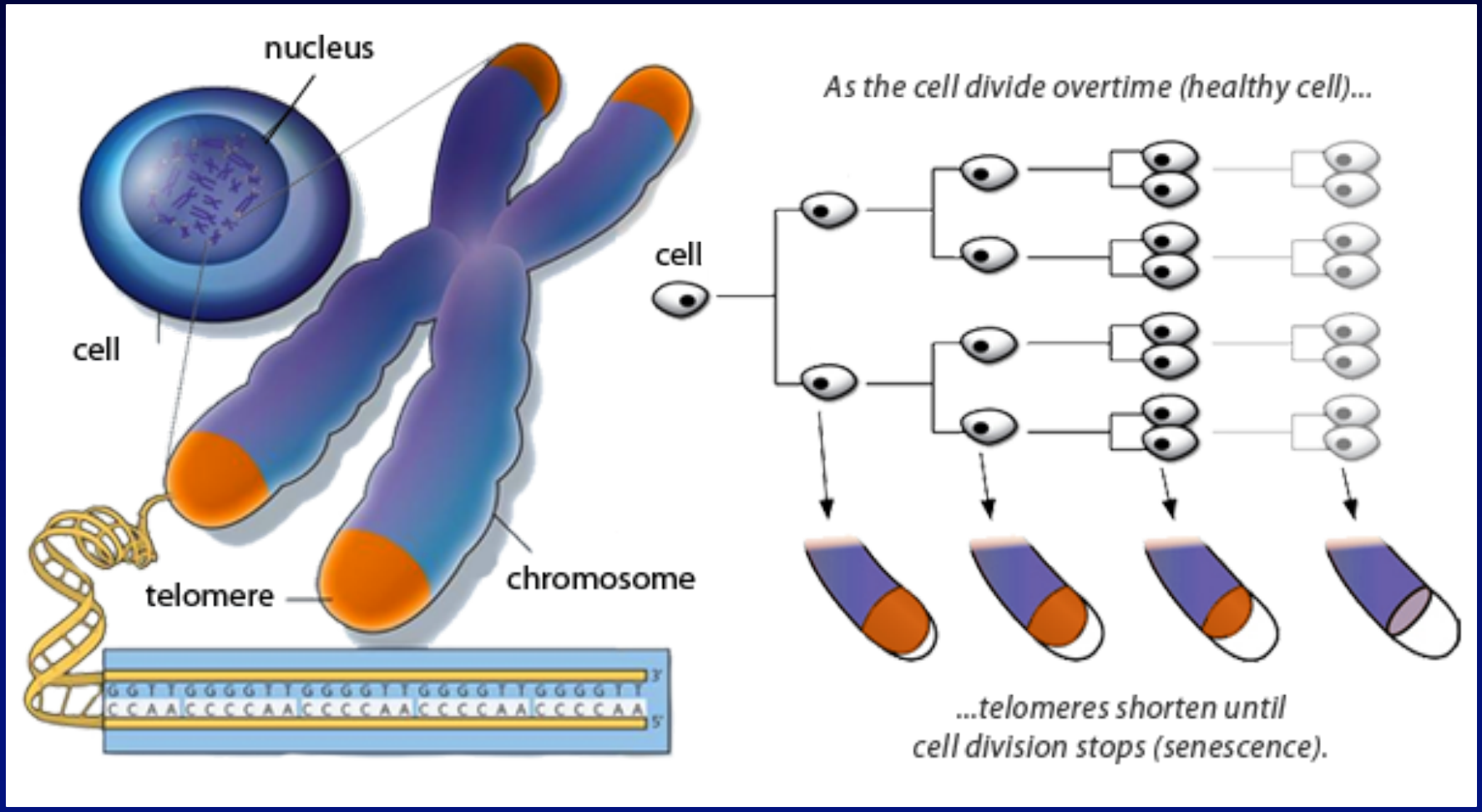


Functional Interconnections Between Hallmarks of Aging

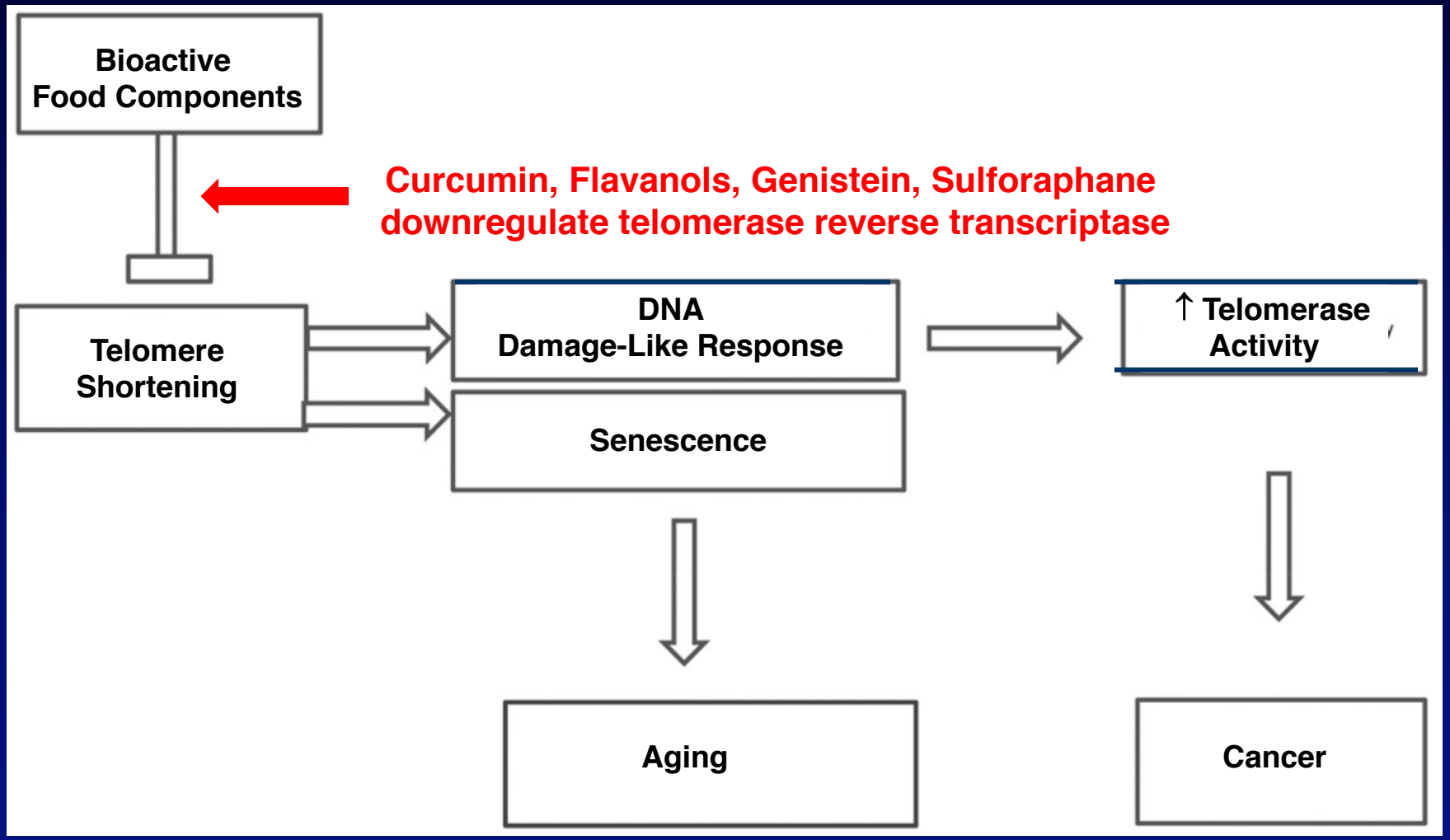


López-Otin et al. *Cell* 2013

Telomere Attrition



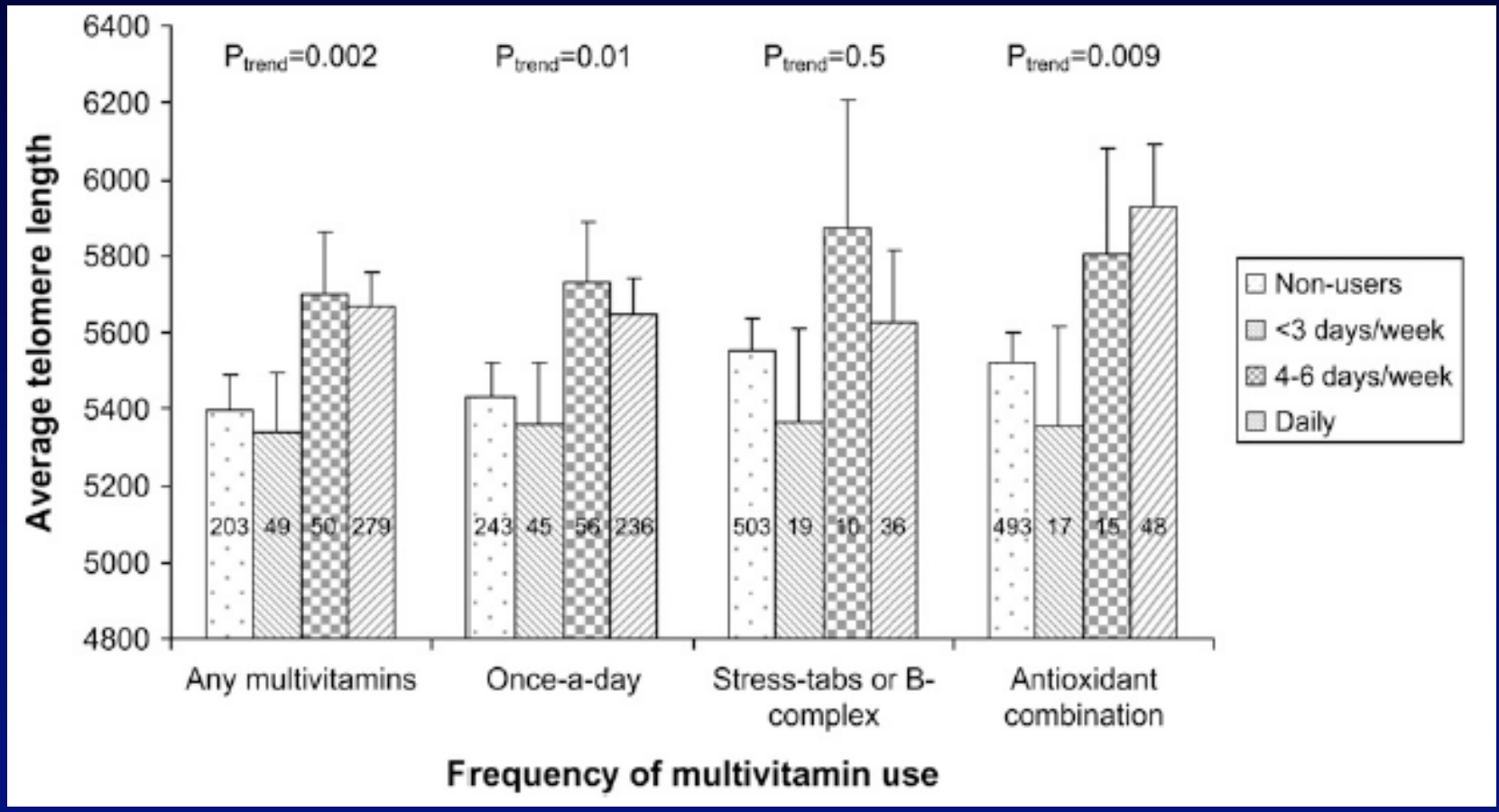
Telomerase as a Target for Phytochemicals



Riscuta. *J Nutr* 2016

Multivitamin Use is Positively Associated with Telomere Length in Women

Sister Study

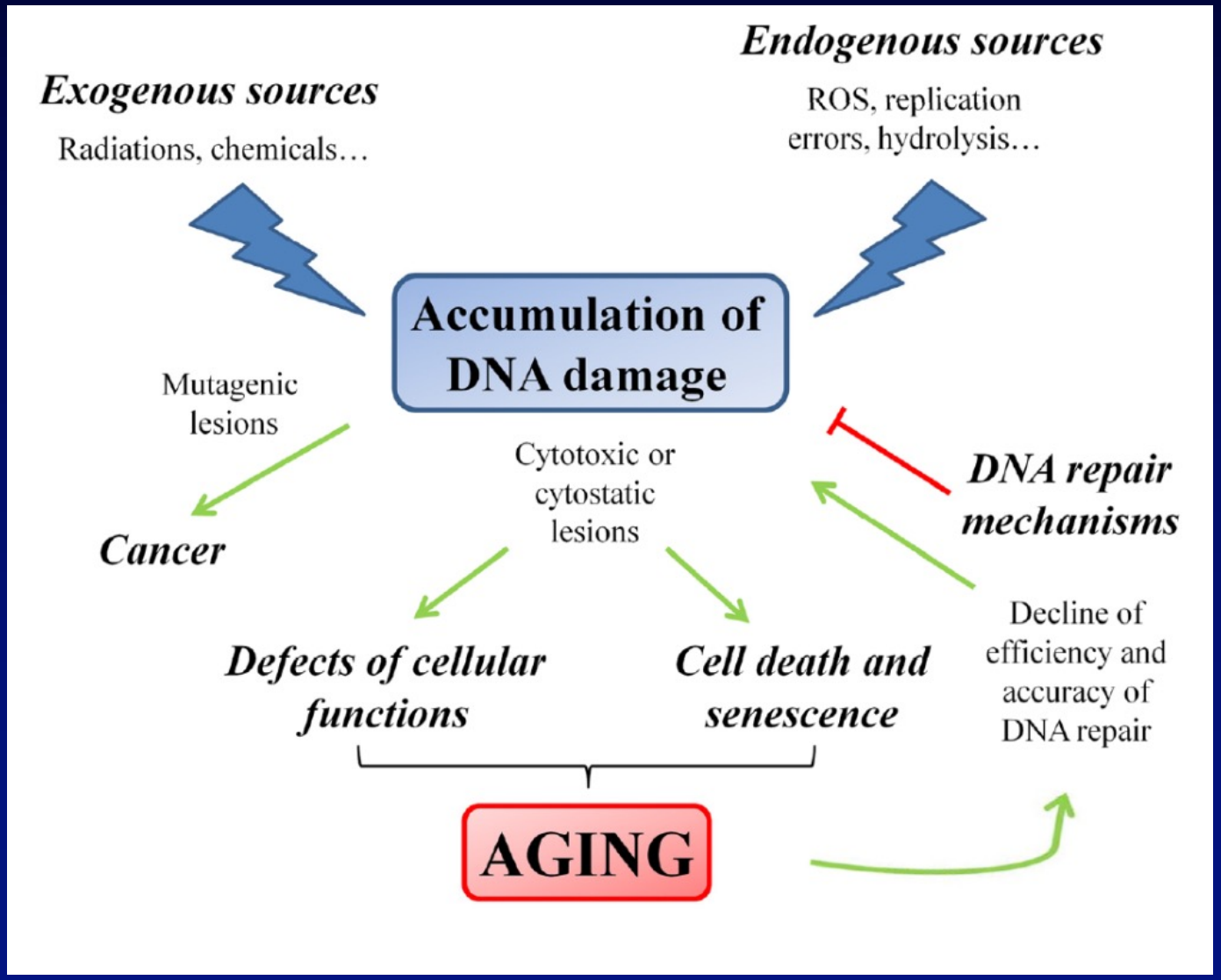


Cohort XS

- **n, 586**
- **age, 35-74**

Xu et al. *Am J Clin Nutr* 2009

DNA Damage Response and Aging



Nicolai et al. *Aging* 2015

β-Carotene, Lutein, and/or Lycopene Protect Against DNA Damage

RCT

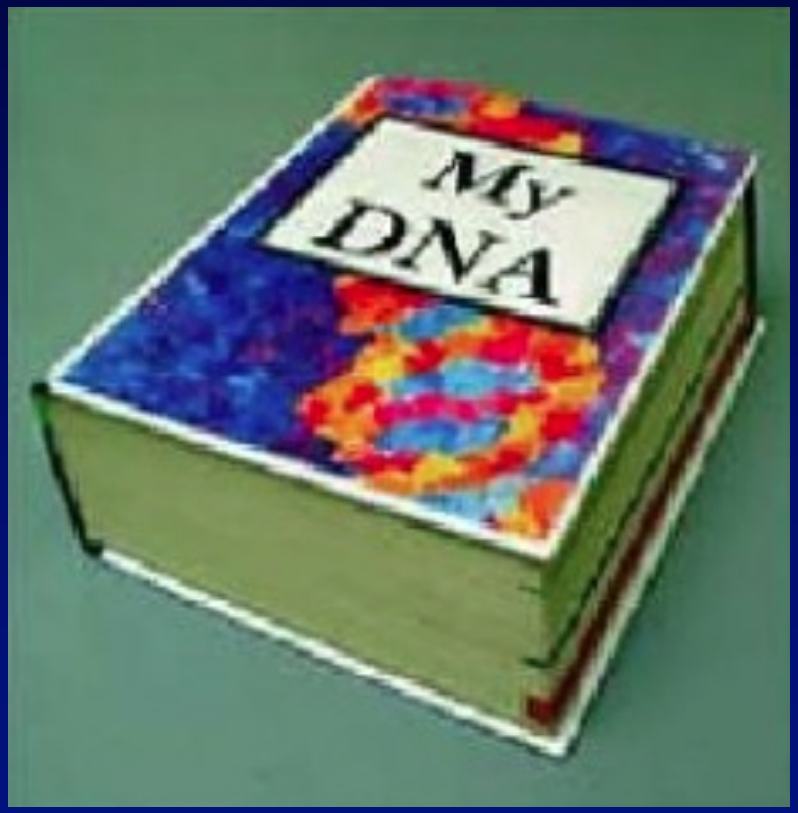
- n, 37 women
- age, 50-70 y
- duration, 56 d
- dose, 12 mg/d

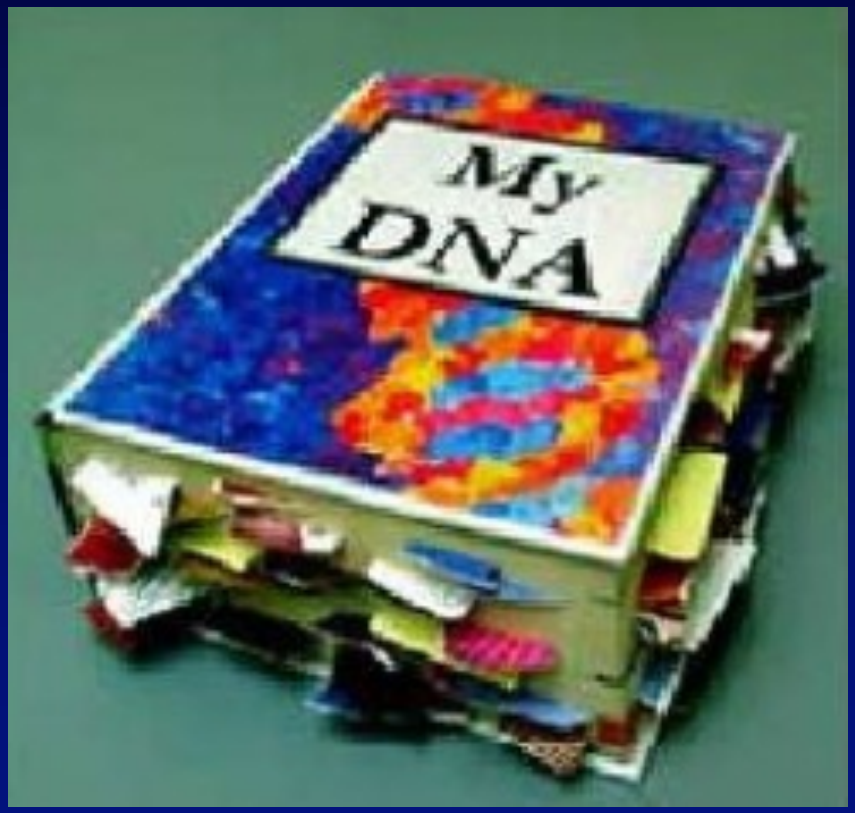
Scores	0	1	2	3	4
Percentage DNA in the tail	<5	5-20	20-40	40-80	>80
Average	2.5	12.5	30	60	90
					
	0%	6.8%	25%	55%	85%
					
	0%	12%	28%	65%	97%

Group	Day 1	Day 15	Day 29	Day 43	Day 57
Endogenous DNA damage (%)[2]					
Placebo ($n = 6$)	8.7 ± 0.8	9.0 ± 1.0	10.6 ± 1.3	9.2 ± 1.7	9.9 ± 1.5
Mixed carotenoids ($n = 8$)	10.9 ± 0.6	8.6 ± 0.6[3]	7.9 ± 0.7[3]	7.1 ± 0.5[3]	7.0 ± 0.4[3]
Lutein ($n = 8$)	10.6 ± 0.5	9.4 ± 0.7	9.5 ± 0.5	7.7 ± 0.5[3]	7.1 ± 0.6[3]
β-Carotene ($n = 7$)	12.4 ± 1.0[4]	9.7 ± 0.9[5]	8.6 ± 1.1[3]	9.4 ± 0.9[3]	8.0 ± 0.7[3]
Lycopene ($n = 8$)	11.9 ± 0.9	10.0 ± 1.2	9.0 ± 0.9[3]	7.5 ± 0.7[3]	6.8 ± 0.6[3]
Hydrogen peroxide–induced DNA damage (%)[6]					
Placebo ($n = 6$)	42.1 ± 2.2	44.6 ± 2.4	39.7 ± 1.1	43.0 ± 2.9	40.6 ± 3.1
Mixed carotenoids ($n = 8$)	44.2 ± 2.5	43.2 ± 3.3	42.6 ± 2.9	37.1 ± 4.0	36.4 ± 2.2
Lutein ($n = 8$)	42.8 ± 2.4	43.5 ± 2.2	43.1 ± 2.0	41.5 ± 3.3	39.8 ± 3.0
β-Carotene ($n = 7$)	48.2 ± 2.3	44.5 ± 3.4	41.1 ± 2.4	44.2 ± 2.1	38.0 ± 1.8
Lycopene ($n = 8$)	50.5 ± 3.2	49.2 ± 3.6	51.1 ± 1.2	50.0 ± 2.3	42.5 ± 2.3

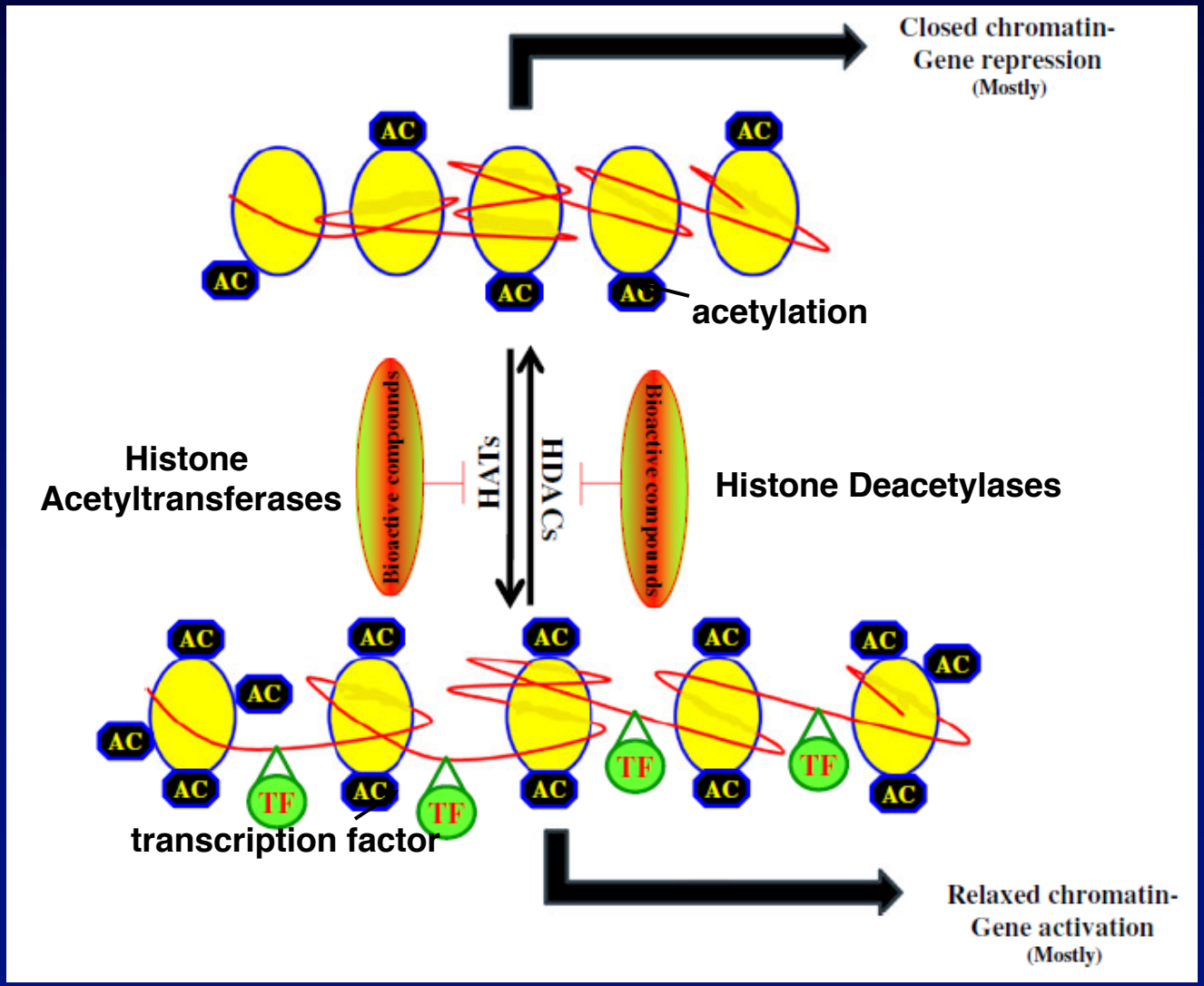
Zhao et al. *Am J Clin Nutr* 2006

DNA Damage:
Genetics vs. Epigenetics



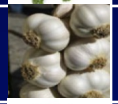
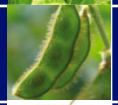


HATs Relax Chromatin ➡ Gene Activation
HDACs Close Chromatin ➡ Gene Repression



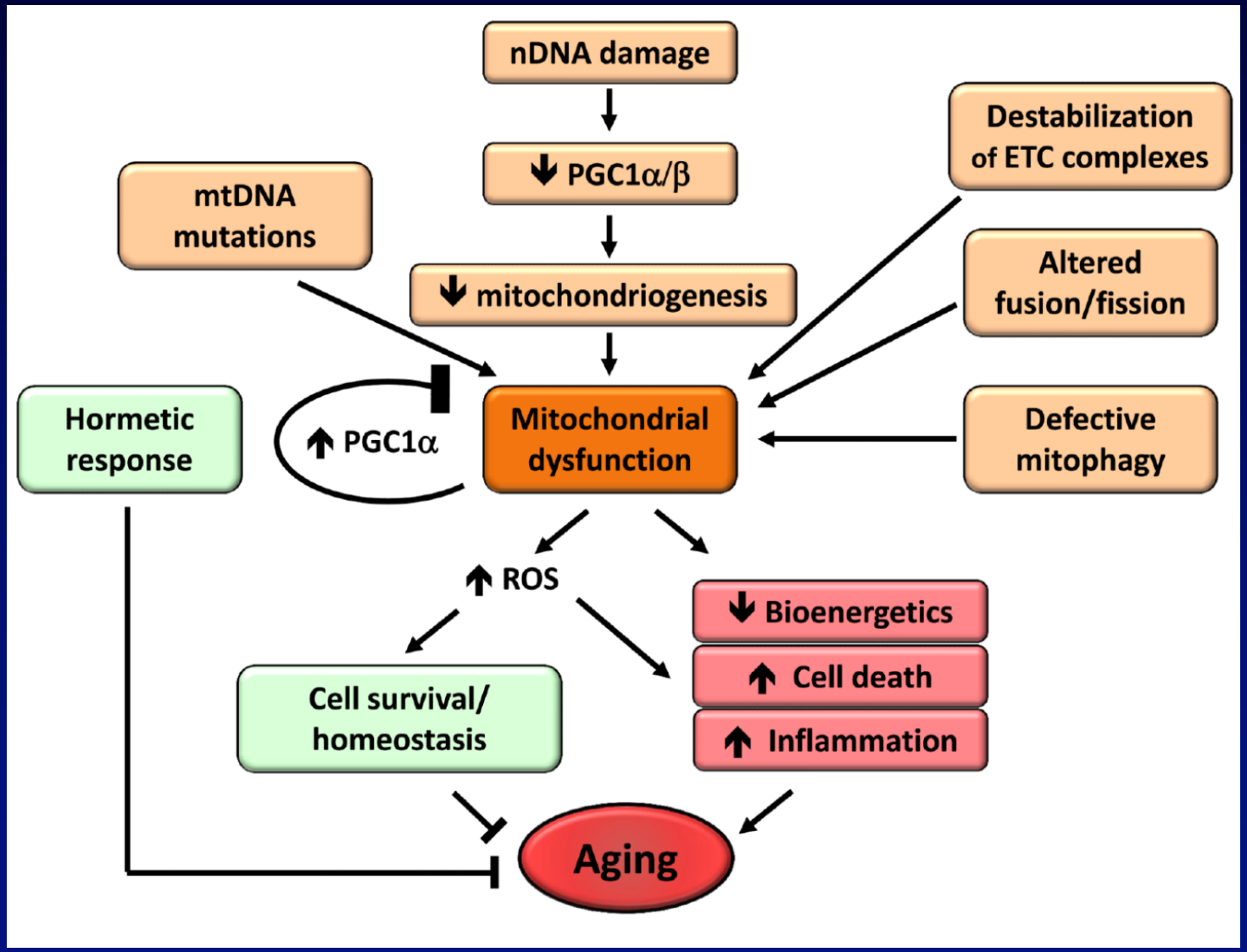
Meeran et al. *Clin Epigenetics* 2010

Epigenetic Targets of Phytochemicals

Dietary Bioactive	*Epigenetic Target*
Apigenin 	↓DNMT
Allyl mecaptan 	↓HDAC
Curcumin 	↓DNMT, HDAC, HAT
EGCG 	↓DNMT, HAT
Genistein 	↓DNMT, HDAC ↑HAT
Resveratrol 	↓DNMT ↑SIRT1
Silymarin 	↑SIRT1
Sulforaphane 	↓DNMT, HDAC

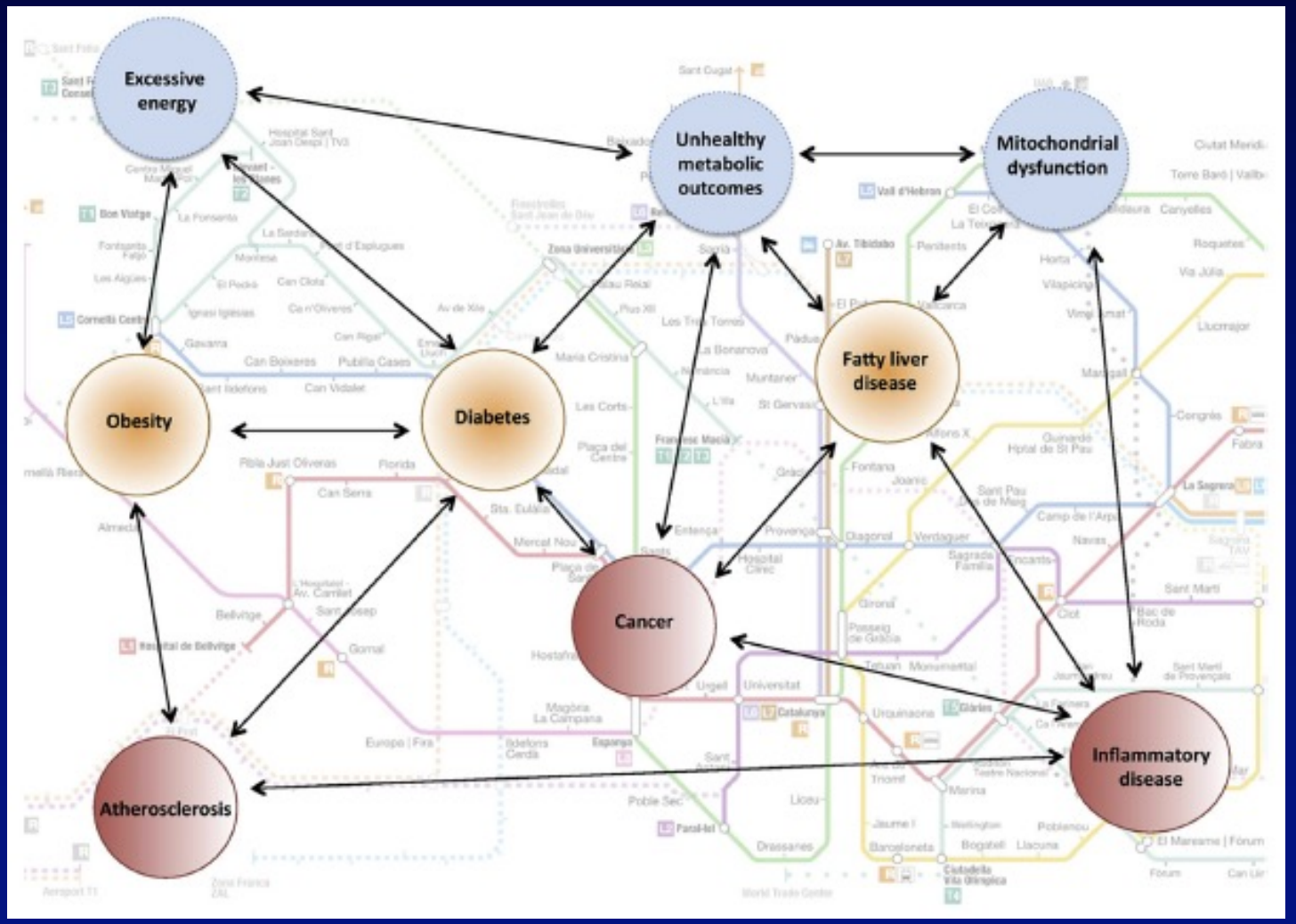
Meeran et al. *Clin Epigenetics* 2010

Mitochondrial Dysfunction as a Target for Aging



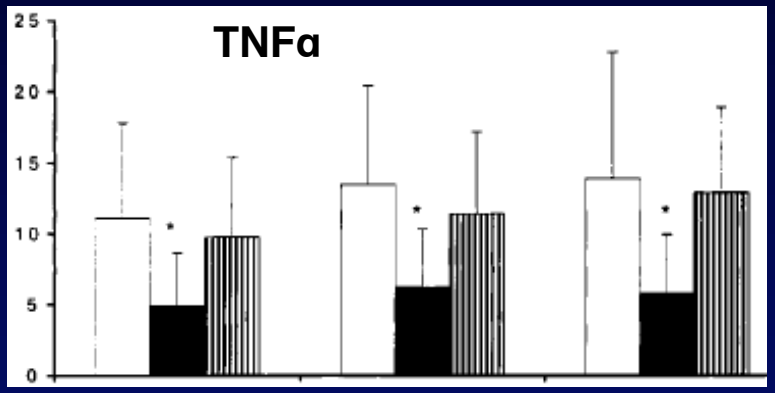
López-Otin et al. *Cell* 2013

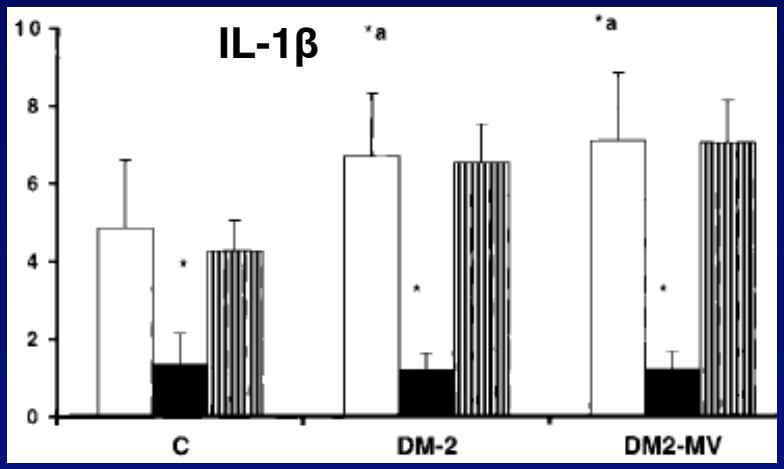
Dynamic Network Links Cellular Pathways of Inflammation and Mitochondrial Function to Food and Nutrients

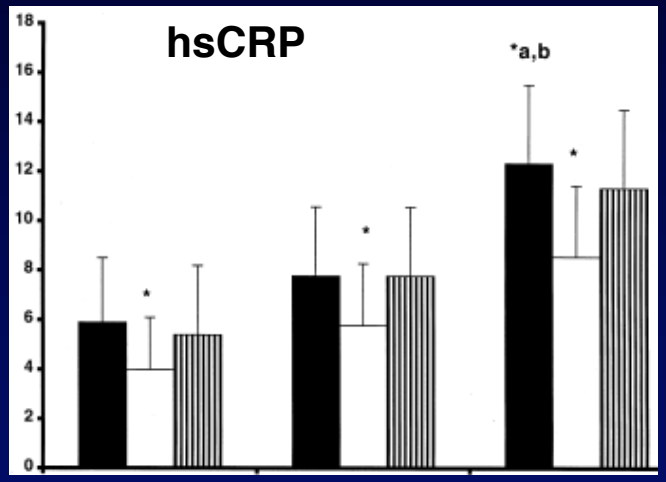


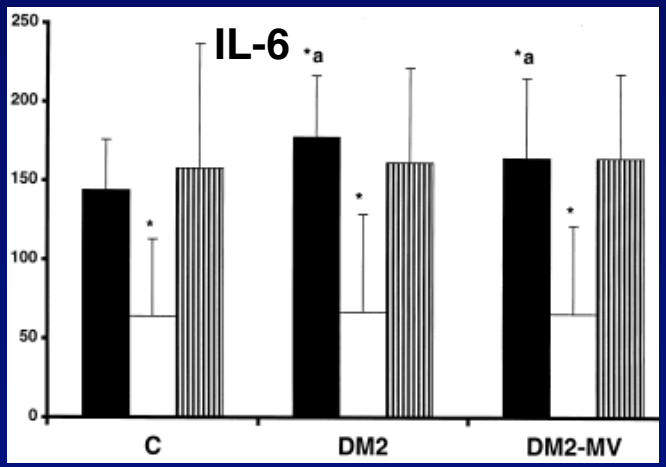
Hernandez-Aguilera et al. *Food Chem Tox* 2016

Anti-inflammatory Actions of Vitamin E







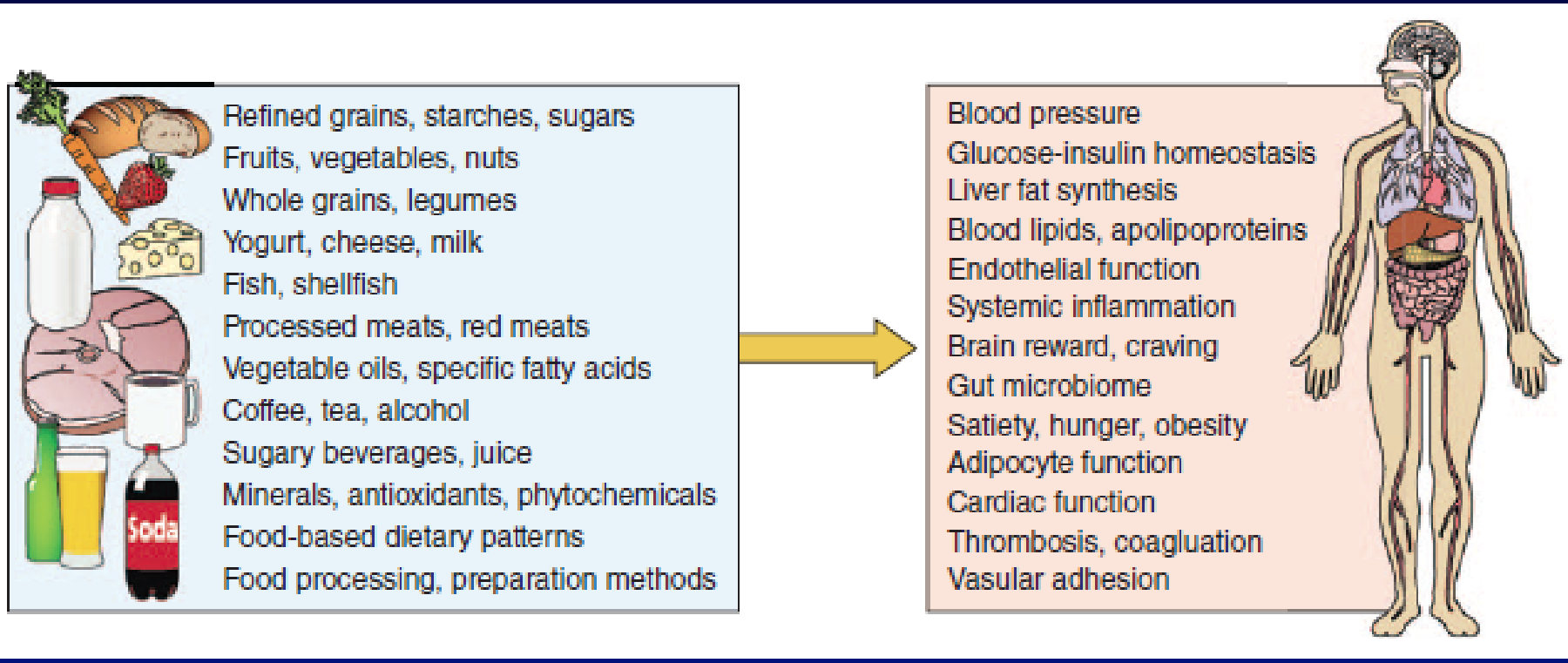


RCT

- n, 75
- age, 57 y
- F/U, 3 mo
- dose, 1200 IU/d

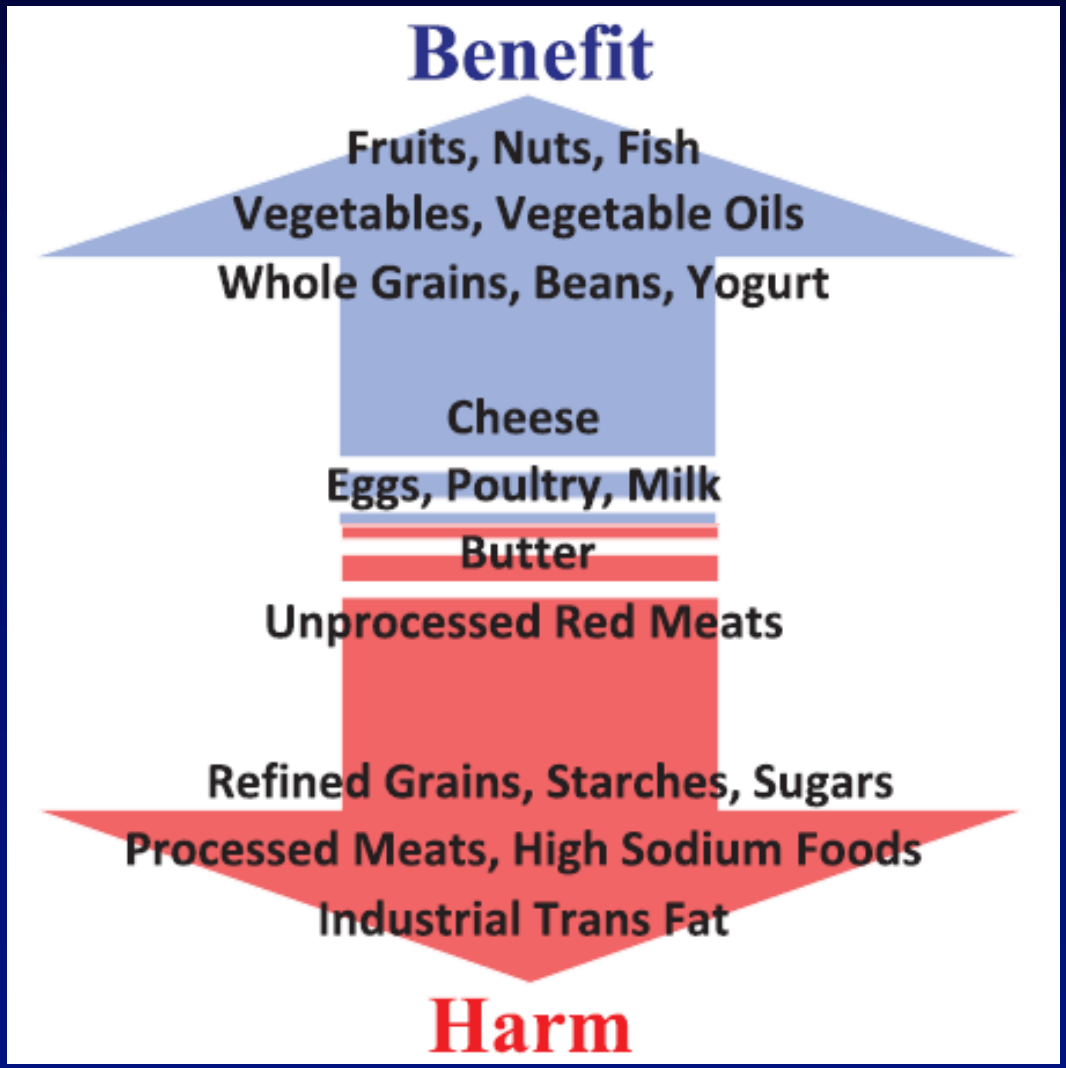
Devaraj et al. *Free Radic Biol Med* 2000
Devaraj et al. *Circulation* 2000

Supoptimal Dietary Patterns are a Leading Cause of Poor Health



Mozaffarian *Circulation* 2016

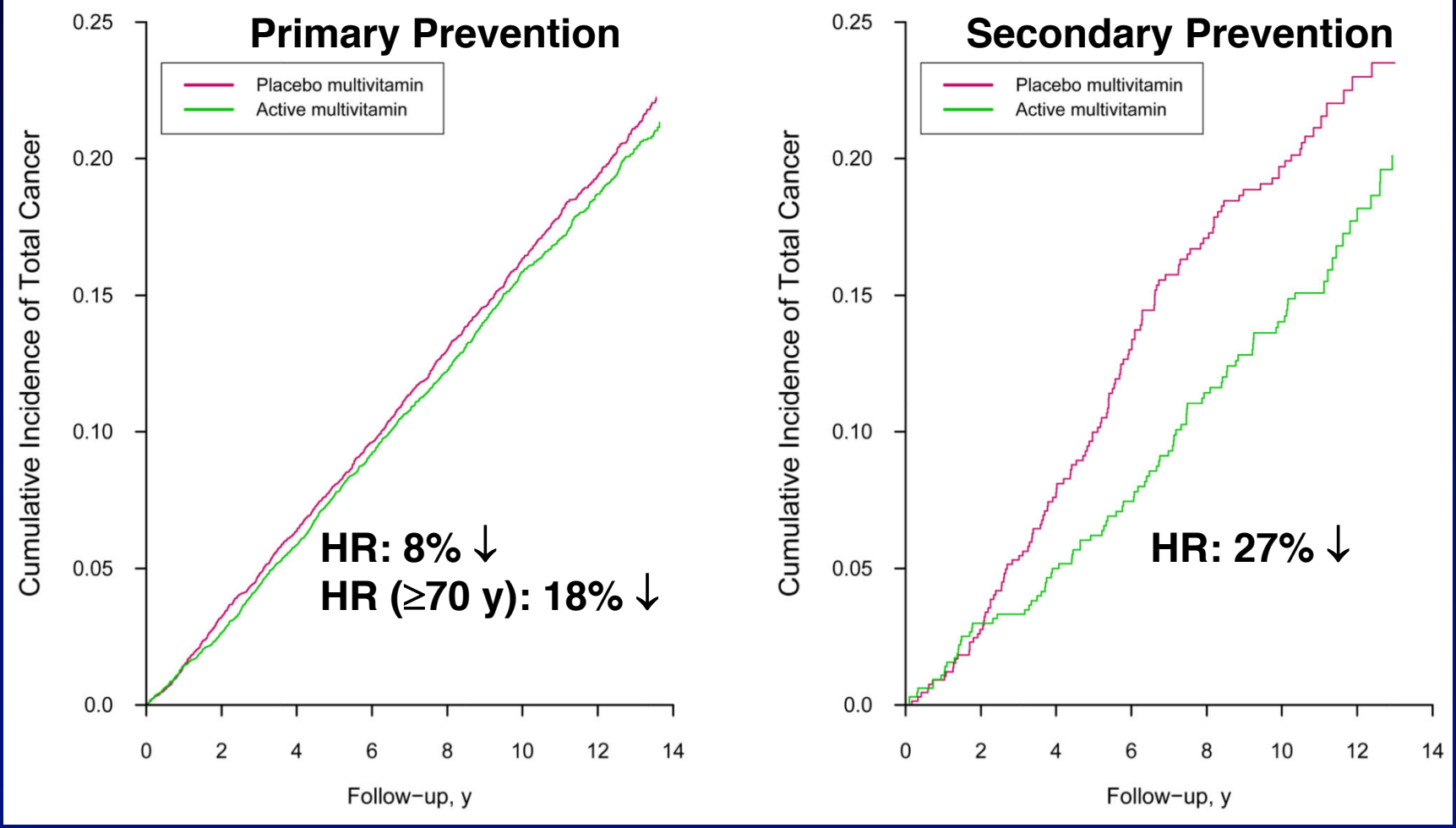
Evidence-based Dietary Priorities for Cardiometabolic Health



Mozaffarian *Circulation* 2016

Multivitamins Reduce the Risk of Total Cancer

Physicians' Health Study II



RCT

- **n, 14,641 men**
- **age, ≥50 y**

Gaziano et al. *JAMA* 2012

Antioxidants Slow Progression to Age-Related Macular Degeneration

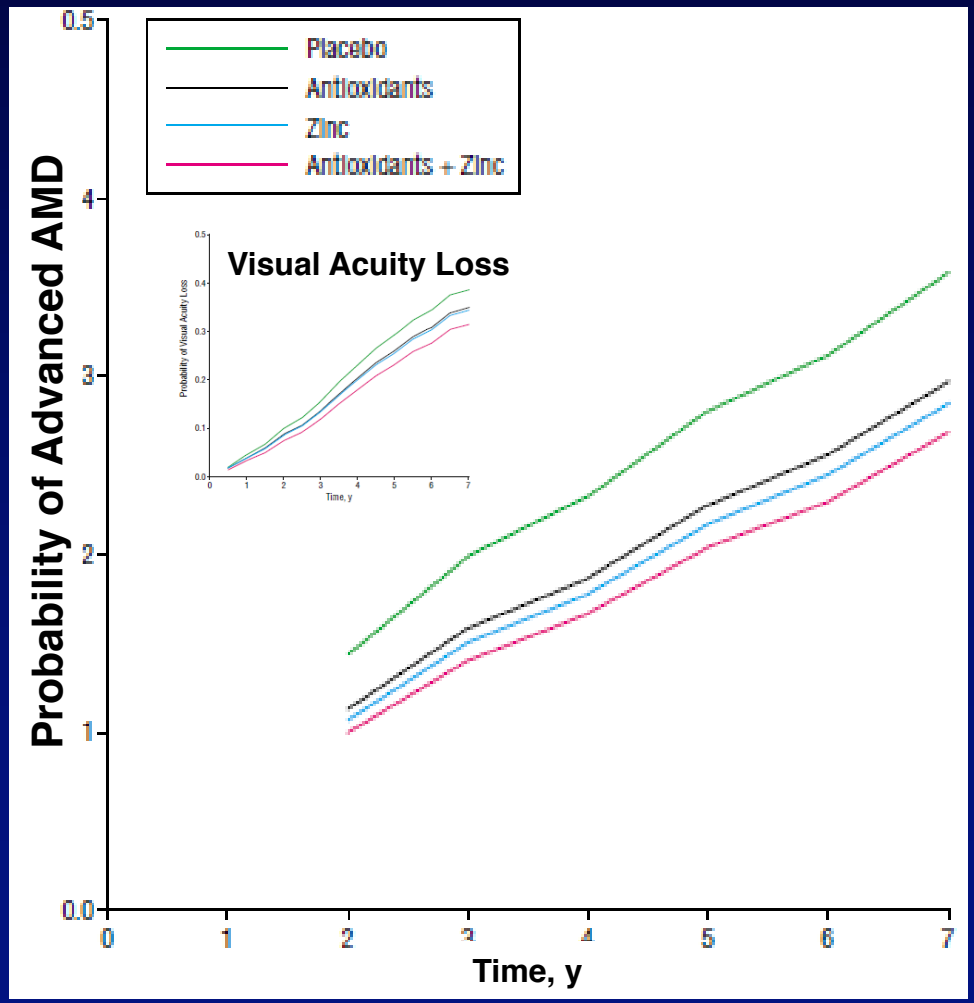
Age-Related Eye Disease Study

RCT

- n, 4757
- age, 55-80 y
- F/U, 7 y

SUPPLEMENT

- Vitamin E, 400 IU
- Vitamin C, 500 mg
- β-Carotene, 15 mg
- Zinc, 80 mg
- Copper, 2 mg



AREDS Research Group. *Arch Ophthalmol* 2001

Flavonoid Intake at Midlife Promotes Healthy Aging in Women

Nurses' Health Study

Prospective Cohort

- n, 13,818
- age, 74 y
- F/U, 15 y

Healthy Aging Criteria

- Survive to ≥70 y
- No major chronic diseases
- No major physical impairments in cognitive, physical function or mental health

Samieri et al. *Am J Clin Nutr* 2014

Flavonoid Intake at Midlife Promotes Healthy Aging in Women

Nurses' Health Study

1517 of 13,818 women (11%) met criteria for healthy aging

Flavonoid	OR
Flavonols	18% ↑
Flavones	32% ↑
Flavanones	28% ↑
Anthocyanins	25% ↑
Total Flavonoids	47% ↑

Samieri et al. *Am J Clin Nutr* 2014

Anthocyanins Reduce the Risk of Incident Hypertension and Myocardial Infarction

Nurses Health Study II

n	87,242	93,600
Age, y	25-42	25-42
F/U, y	14	18
Q1 – Q5, mg/d	5.7-21.9	2.5-25.1

Quintile	iHT	MI
1	--	--
2	6% ⬇	20% ⬇
3	7% ⬇	29% ⬇
4	9% ⬇	15% ⬇
5	13% ⬇	32% ⬇
P	*0.0001*	*0.047*

Cassidy et al. *Am J Clin Nutr* 2011 *Circulation* 2013

Healthy Aging as Outcome Criteria
SU.VI.MAX 2

RCT

- n, 3996
- age, 65.3 ± 4.5 y
- intervention, 8 y
- F/U, 15 y

SUPPLEMENT

- Vitamin C, 120 mg
- Vitamin E, 30 mg
- β-carotene, 6 mg
- Selenium 100 μg
- Zinc, 20 mg

Criteria[a]	Definition	Corresponding Rowe and Kahn Criterion[b]
Good physical functioning	SPPB ≥11 of 12	Maintenance of high physical and cognitive function
Good cognitive functioning	MMSE ≥27, RI-48 ≥19 of 48, and DK-TMT ≥5.5	Maintenance of high physical and cognitive function
No limitations in IADL	<1 limitation	Avoiding disease and disability
No depressive symptoms	CES-D <16 of 60	
No health-related limitations in social life	SF-36 responses: 1–2 for item 6 and 3–5 for item 10	Sustained engagement in social and productive activities
Good overall self-perceived health	SF-36 responses: 1–3 for item 1	
No function-limiting pain	SF-36 responses: 1–3 for item 7 and 1–2 for item 8	Avoiding disease and disability
No incident major chronic disease	No incident diabetes, cancer, or cardiovascular disease during follow-up	Avoiding disease and disability

Assmann et al. *Am J Epidemiol* 2015

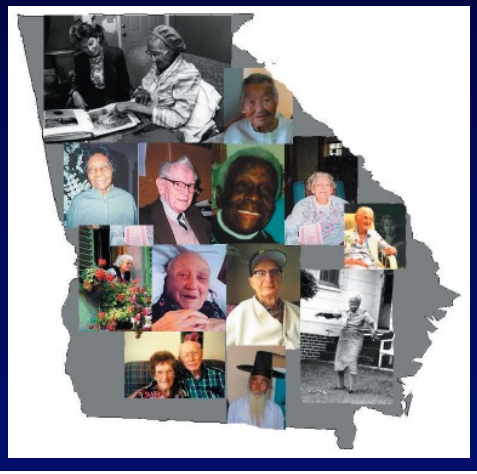
Antioxidant Supplementation as a Predictor of Healthy Aging

Stratification Variable	Total n	RR
All participants	3996	7% ⬆
Men	2027	16% ⬆
Vitamin C status, <42 μmol/L	727	28% ⬆
Zinc status, <11.9 μmol/L	953	26% ⬆
F&V (<400 g/d)	1757	17% ⬆

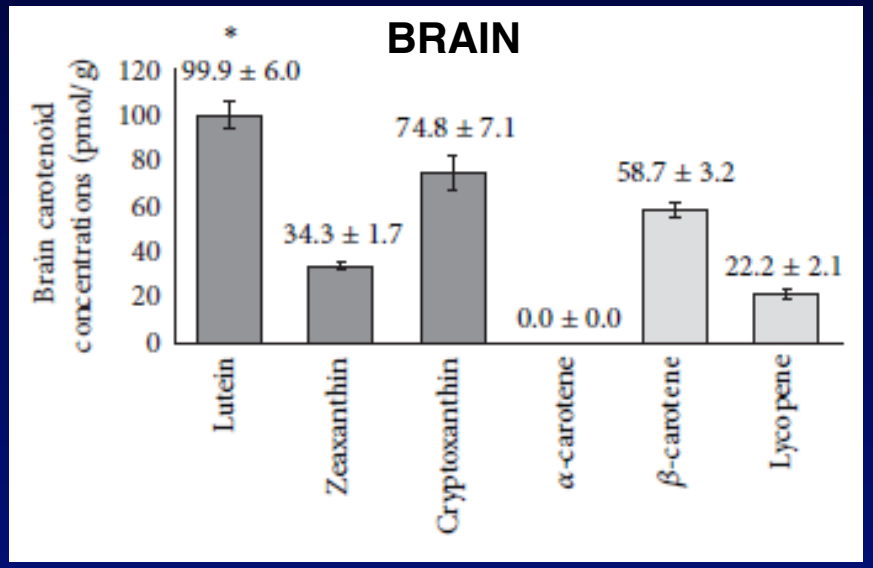
Assmann et al. *Am J Epidemiol* 2015

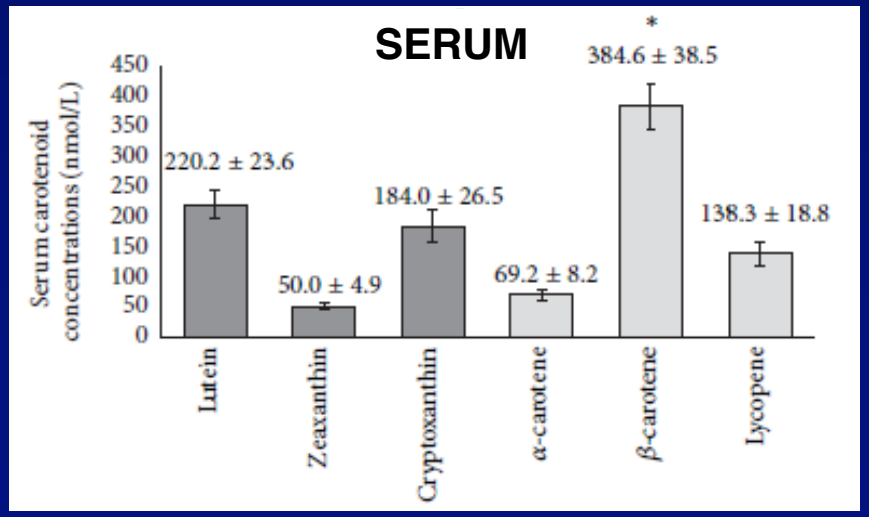
Lutein is Concentrated in Brain and Correlated with Cognitive Performance in Elderly

The Georgia Centenarian Study



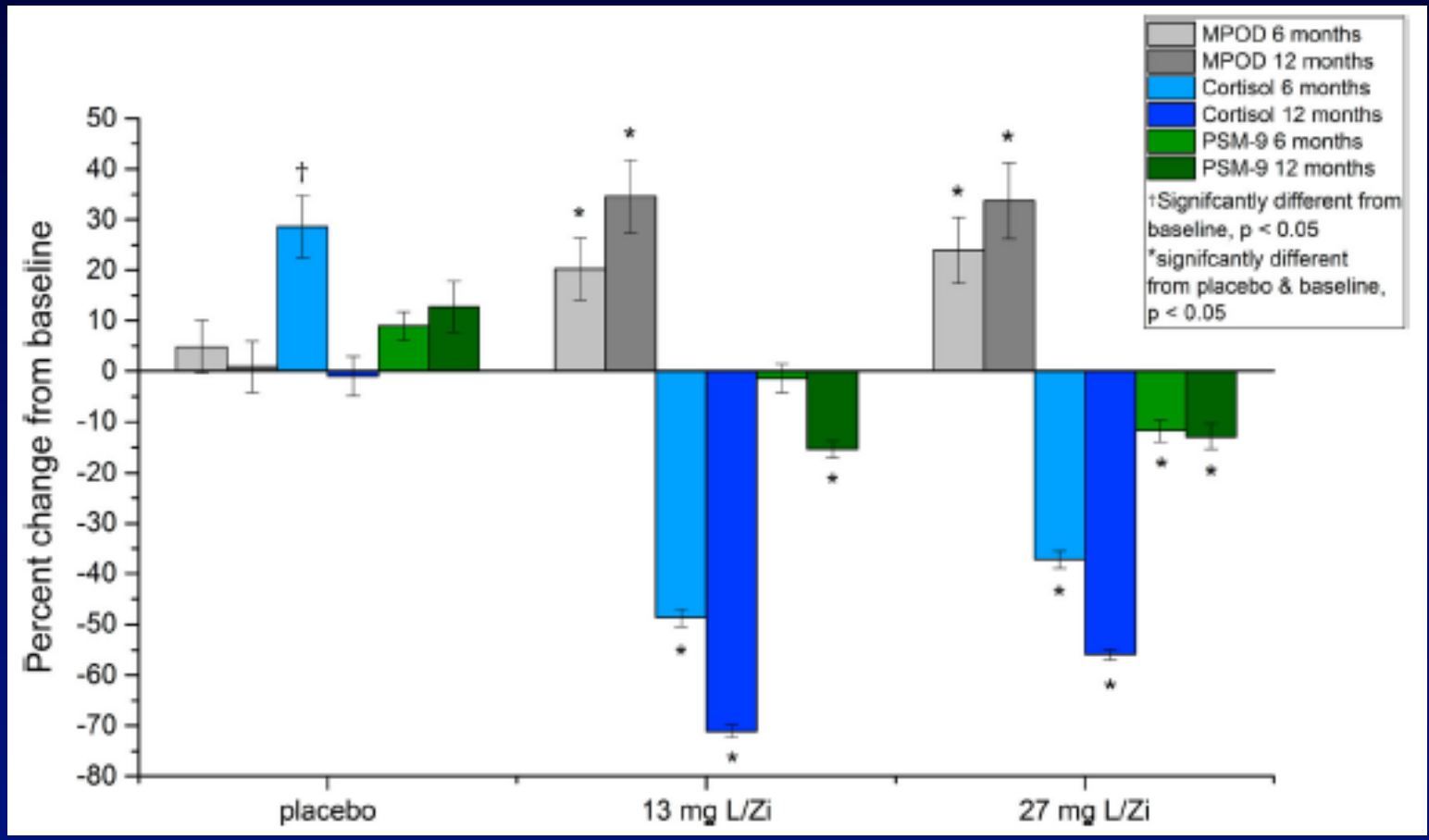
	MMSE
Lutein (*trans* + *cis*)	0.494[a]
Zeaxanthin	0.439
Cryptoxanthin	−0.056
β-Carotene, *trans*	0.265
Lycopene, *trans*	0.124
α-Tocopherol	0.393
Retinol	0.161





Johnson et al. *J Aging Res* 2014

Lutein/Zeaxanthin Supplementation Reduces Psychological Stress and Serum Cortisol



RCT

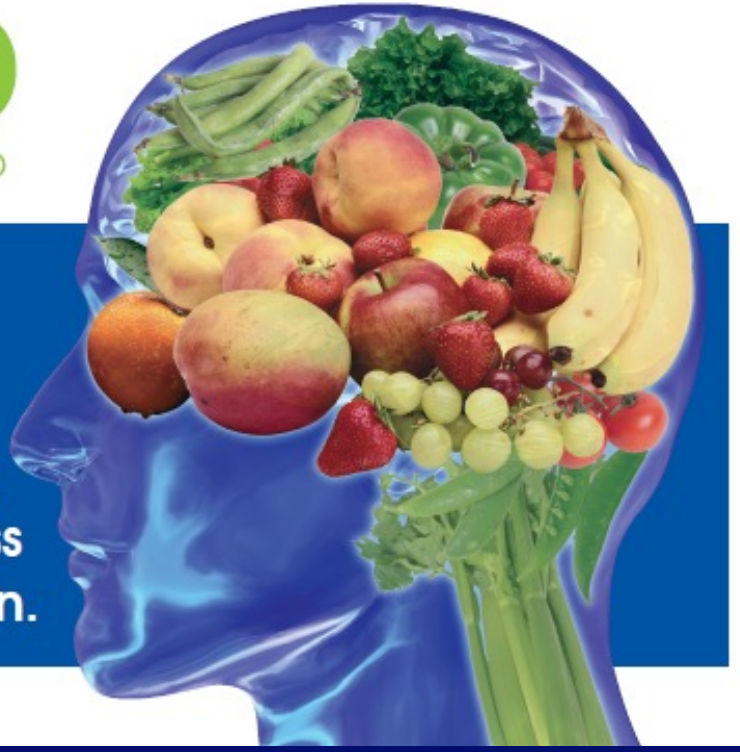
- **n, 59**
- **age, 21.5 y**
- **BMI, <27.0**

Stringham et al. *Nutr Neurosci* 2017

MooDFOOD

PREVENTING DEPRESSION THROUGH FOOD

Depression is one of the most prevalent and disabling disorders in the EU. MooDFOOD is one of the largest consortia investigating depression, and the first to address the role of nutrition in its prevention.



ABOUT:

RCT

- n, 1000
- age, 18-75 y
- BMI, 25-40
- duration, 12 mo

Supplement

- EPA + DHA, 1412 mg
- calcium, 100 mg
- selenium 30 μg
- folic acid, 400 μ g
- vitamin D3, 20 μg

Roca et al. *BMC Psychiatry* 2016


The Secret of
Healthy
Aging

The Role of Essential Nutrients in the Continuum of Health

Sick

Not Sick

Well

WHO - Active Ageing: A Policy Framework

- Prevent and reduce the burden of excess disabilities, chronic disease and premature mortality
- Reduce risk factors associated with major diseases and increase factors that protect health throughout the life course
- Develop a continuum of affordable, accessible, high-quality and age-friendly health and social services that address the needs and rights of people as they age
- Provide training and education to caregivers

World Health Organization; 2002 (WHO/NMH/NPH/02.8; http://whqlibdoc.who.int/hq/2002/who_nmh_nph_02.8.pdf)


1745
337
1338
412
2464