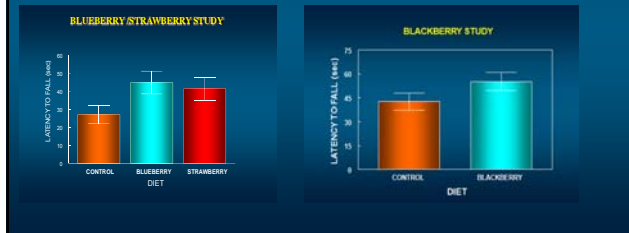
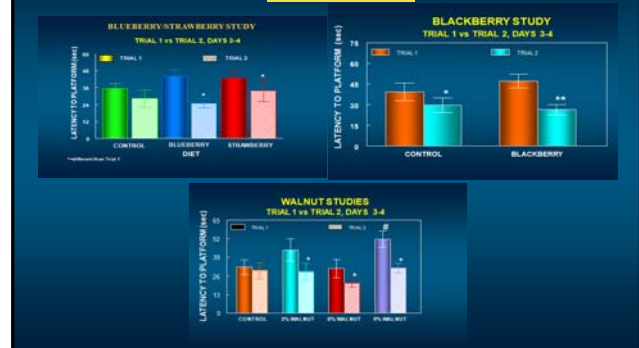


BERRY-INDUCED INCREASES IN ROTOROD PERFORMANCE IN OLD ANIMALS



MORRIS WATER MAZE PERFORMANCE



Behavioral and Neruonal Effects of Cocoa Extract

- Bisson et al., (2008) examined whether a 1-year administration of a cocoa polyphenolic extract (Acticoa powder), orally delivered at the dose of 24 mg/kg per d between 15 and 27 months
 - of age, affects the onset of age-related cognitive deficits, urinary free dopamine levels and lifespan in old Wistar-Unilever rats.
 - Acticoa powder:
 1. improved cognitive performances in light extinction water maze paradigms,
 2. increased lifespan
 3. preserved high urinary free dopamine levels.
- British Journal of Nutrition (2008), 100, 94-101

3

The effect of flavanol-rich cocoa on the fMRI response to a cognitive task in healthy young people.

In this study Francis et al., (2006) used functional magnetic resonance imaging to assess blood oxygenation to a cognitive task in health young volunteer humans. The data indicated an significant increase in blood oxygenation in response to the task in the voluteers given flavanol-rich cocoa (5 days of 150 mg of cocoa flavanols).

Francis et al., J Cardiovasc Pharmacol. 2006;47 Suppl 2:S215-20

4

Anthocyanins in the Brains of Old Rats

1. Latency to platform on Day 4 vs. the number of cortical anthocyanins: $r=-0.78$, $P<.03$, ie, as anthocyanin number increased, the latency to find the platform decreased, particularly on the day when the platform was moved from one quadrant to another.
2. Number of crossings of the previous platform location on the Day 3 probe trial (when the platform was removed) vs. the number of hippocampal anthocyanins: $r=0.98$, $P<.02$, ie, as anthocyanin number increased, the number of crossings increased, indicating a more thorough search strategy. *Nutr Neurosci.* 2005;8:111-120.

Fruits and Veggies That Alter Behavioral Deficits in Aging

- Memory
 - Spinach
 - Strawberries
 - Cranberries
 - Black currant
 - Purple Grape Juice
 - Plum Juice
 - Blueberries
 - Walnuts
- Motor:
 - Cranberries
 - Purple Grape Juice
 - Blueberries
 - Strawberries
 - Walnuts

Possible Mechanisms in the Beneficial Effects of the Polyphenolics

- ◆ Functional antioxidant effects/anti-inflammatory effects
 - Decreased sensitivity to oxidative stress
 - Decreased sensitivity to neurotoxins and inflammatory agents
 - Increased calcium clearance
 - Membrane effects.
 - Alterations in signaling
 - Decreased inflammatory signaling
 - Decreased oxidative stress signaling
 - Increased protective signaling
 - Signaling in learning and memory

RADIATION STUDIES

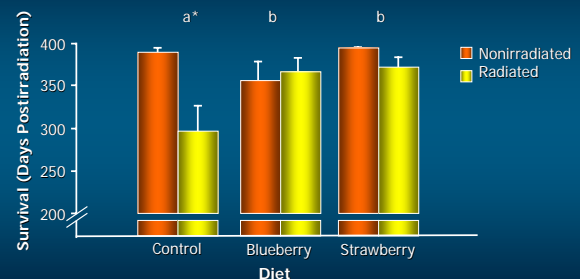
- ◆ Conducted in collaboration with Bernie Rabin at UMBC, grant from NASA
- ◆ Young (3 mo) Rats irradiated at Brookhaven National Laboratory – ^{56}Fe particles
- ◆ Radiation effects similar to that seen with aging; radiation produces oxidative stress and inflammation
- ◆ Can supplemented diets prevent these deficits?

Radiation Studies: Summary Morris Water Maze

We fed young (3 mo) rats SB or BB (2%, 8 wks.) and the exposed them to 1.5 Gy ^{56}Fe irradiation. They were then tested on the Morris water maze under various paradigms. Results indicated that:

1. **Blueberry supplementation** prevented irradiation-induced deficits in memory tasks that depend on intact striatal functioning such as **reversal (spatial)** learning (when the platform was moved from one quadrant to another).
2. **Strawberry supplemented** animals showed fewer deficits on the probe trial measures (when the platform was removed from the water maze), suggesting retained **place** information, which is a hippocampally dependent behavior.
3. **Perhaps, with cognitive performance**, the polyphenolic compounds in blueberries are working mainly in the striatum, while those in strawberries are primarily affecting the hippocampus.

Effects of Irradiation and Diet on Survival Time



*Means not sharing a common letter are significantly different from one another ($P < .05$).
Courtesy of J. Joseph, PhD.

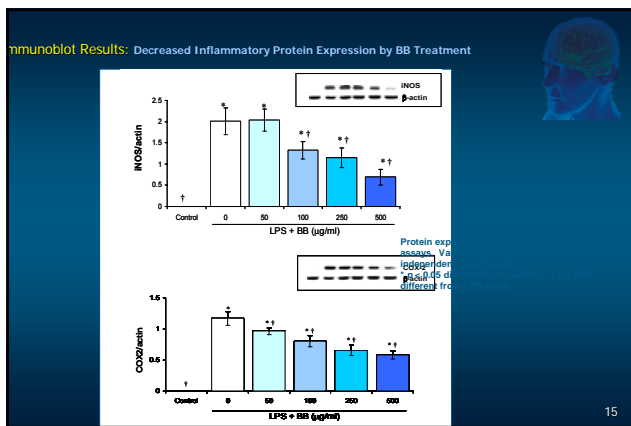
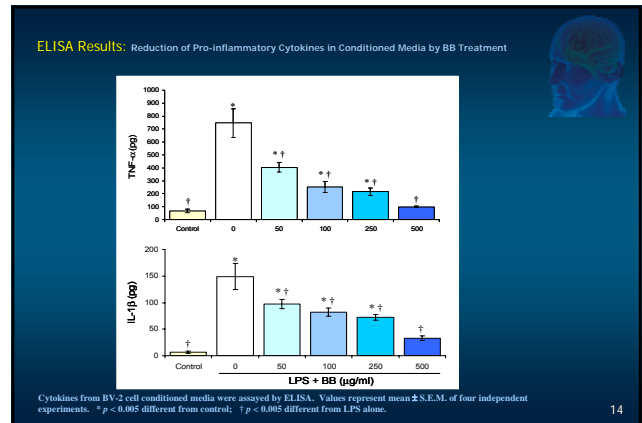
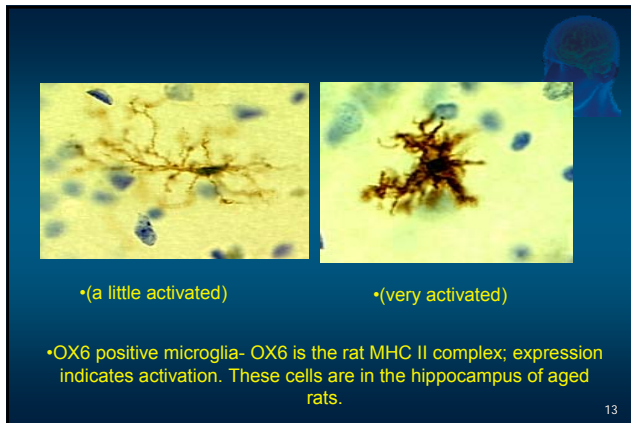
Possible Mechanisms in the Beneficial Effects of the Polyphenolics

- ◆ Functional antioxidant effects/anti-inflammatory effects
 - Decreased sensitivity to oxidative stress
 - Decreased sensitivity to neurotoxins and inflammatory agents
 - Increased calcium clearance
 - Membrane effects.
 - Alterations in signaling
 - Decreased inflammatory signaling
 - Decreased oxidative stress signaling
 - Increased protective signaling
 - Signaling in learning and memory

BV-2 Mouse Microglial Cells

And Inflammatory Markers

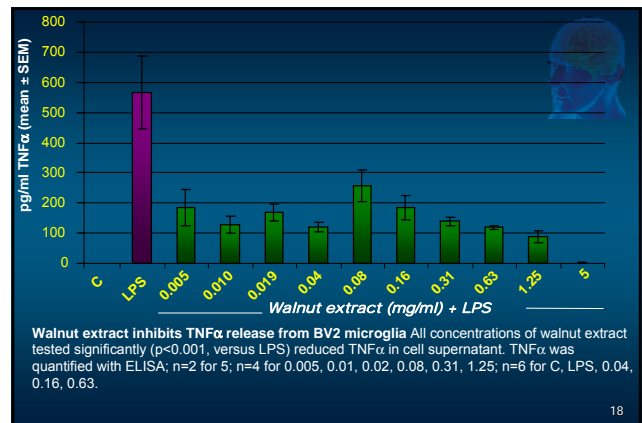
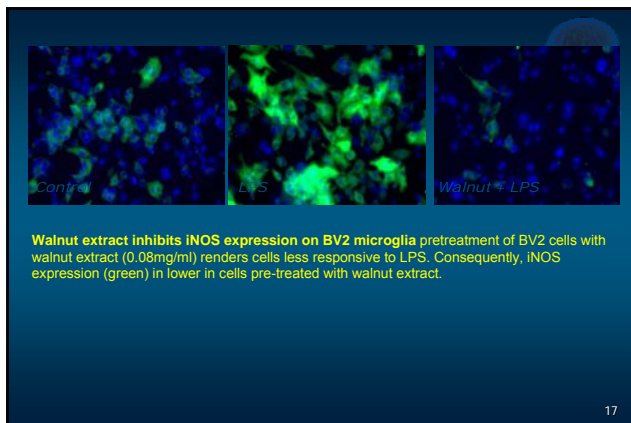




Percentage of Total Fatty Acids in Walnuts and Methanolic Extract of Walnut

	Walnuts	Walnut Extract
Linoleic acid (polyunsaturated, 18:2 ω -6)	61.21%	57.1%
Alpha-linolenic acid (polyunsaturated, 18:3 ω -3)	14.59%	13.7%
Palmitic acid (saturated, 16:0)	7.07%	10%
Oleic acid (monounsaturated, 18:1 ω -9)	14.14%	9.1%

Walnut extract, as analyzed by LC/MS, reveals the presence of fatty acids at approximately the same percentage of total fatty acids as found in the walnut itself. (USDA Nutrient Database, Release 18, 2005)



Kainic Acid Treatment in Rats