Onion and Garlic: Ancient Food, Medicine, and Art

c. 2,500 B.C.E.

c. 2,500 B.C.E.

c. 1,400 C.E.

c. 16th century
Is There a Public Relations Problem?
If History Were A Guide
Functional Foods

Demonstrable health benefit beyond nutrition
Dysunctional Foods?

Demonstrable emotional benefit beyond a doubt
When did we start demanding this?

“Let your food be your medicine and your medicine be your food”

Aristotle

“I hope to have taken the right healthy stuff so I do not have to deal with any disease.”

Baby Boomers
Great expectations

Much has been expected of our foods, including fruits and vegetables, to promote physical well-being.

They have been promoted prescriptively as medicines, and turned into “silver bullet” cures for a variety of ailments.

Is this leading us down a path of disappointment?
The end of human culture: The Tomato Pill
The Pomegranate

Ancient Egypt

Ancient Rome

Botticelli, 1487
Modern marketing
Health Benefits?

Cheat death.

You need more than luck to live longer. You need antioxidants. And POM Wonderful 100% Pomegranate Juice is loaded with them. It helps guard your body against free radicals, unstable molecules that emerging science suggests aggressively destroy healthy cells in your body and contribute to disease. POM Wonderful 100% Pomegranate Juice is supported by $23 million of medical scientific research from leading universities, which has uncovered encouraging results in prostate and cardiovascular health. So drink a glass a day and cheat death. Live life.

POM Wonderful 100% Pomegranate Juice. The Antioxidant Superpower.

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FTC Ruling

- The FTC complaint alleged that the POM’s claims were false and unsubstantiated because many of their scientific studies did not show benefits from using POM products for treating or preventing heart disease.

- The FTC said the health claims were false and unsubstantiated.
“Pom Wonderful case not wonderful enough, Supreme Court says”
Snake Oil?
# Onion: compounds and potential benefits

<table>
<thead>
<tr>
<th>Compound</th>
<th>Potential Health Benefit</th>
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<tbody>
<tr>
<td>Oligofructose</td>
<td>Digestive health, probiotic</td>
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<tr>
<td>Thiosulfinates</td>
<td>Antithrombotic, Antimicrobial</td>
</tr>
<tr>
<td>Sulfides, ACSOs</td>
<td>Anticancer, Antidiabetic</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Antioxidant, Antithrombotic</td>
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</table>
Cardiovascular Health

Lipid lowering
Blood pressure lowering
Antioxidant
Antithrombotic or Antiplatelet

AHA, 2000
Plaque in coronary artery
Platelets in coronary artery
Platelet aggregate in coronary artery

...Heart attack and stroke
Aggregating Platelets

- A **major cause of heart attack and stroke**
- Approximately 25% of US public has some form of cardiovascular disease
- Preventive measures: aspirin
- Preventive measures: diet?
- Preventive measures: onion?
Aspirin Taken Daily With Bottle Of Bourbon Reduces Awareness Of Heart Attacks

“...According to Katzeff, test subjects who were administered a single aspirin tablet in the morning, followed by a fifth of bonded Kentucky bourbon over the next several hours, were 85 percent less likely to realize they were having a heart attack than subjects who did not take aspirin with bourbon.”

-The Onion
Is onion a functional food?
Schematic of a Whole Blood Platelet Aggregometer

Electrode assembly in cuvette with whole blood

Platelet agonist (e.g. collagen, ADP)

Aggregating platelets

Stir bar (1,200 rpm)

Heating block (37 °C)

Baseline

+ Platelet inhibitor

Chart Recorder

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Defense Compounds

- Sulfur stored as ACSOs
- Tissue disruption initiates lysis of ACSOs
- Causing formation of thiosulfinates
- These compounds deter many pests

[Sulfate] → [ACSOs] → [Alliinase] → [Thiosulfinates] → [Pest resistance]

Fenwick and Hanley, 1986
Flavor and Medicine

- Thiosulfinates confer flavor to food
- Also mask other flavors
- Exhibit a range of unique bioactivities
- Including many of interest to human health

Sulfate → ACSOs → Alliinase → Thiosulfinates → Flavor, Medicine

Block, 1985, Lawson, 1998
Garlic Sulfur Compound Transformation—Redrawn from Lawson, 1998

Whole

γ Glutamyl-S-allylcysteine
γ Glutamyl-S-t-1-propenlcysteine

Alliin
Methiin
Cycloalliin

Crushed

Alliinase

Sulfenic Acids

Allicin + Allyl methanethiosulfinate + Pyruvic Acid

Processed

aqueous
steam distillation
oil or solvent incubation

S-Allylcysteine
S-1-Propenylcysteine
Glutamic acid

Diallyl trisulfide
Diallyl disulfide
Allyl methyl trisulfide
Allyl methyl disulfide

2-Vinyl-4H-1,3-dithiin
2-Vinyl-4H-1,2-dithiin
E-Ajoene

No change
More Potent than Aspirin in Vitro

Impedance (ohms)

control  solvent  aspirin  allicin (0.4mM)

Briggs, 2000
Correlated with pungency and related to sulfur uptake

Can’t be manipulated with more sulfur in the soil

Increases postharvest up to 90 days, then sulfur compounds move to flowers
Folts’ in vivo Coronary Thrombosis Model

Canine

Measure blood flow through constricted coronary artery
Onion Inhibits Platelet Aggregation *in vivo*

A dosage of 1cc juice given intravenously inhibited CFRs within 5 minutes.

Also inhibited intragastrically at 2 g/kg

Briggs, 2000
Cooking

• >1 minute of boiling eliminates all in vitro OIAA
• Suggests volatility of OSCs, heat-killing of alliinase

Kopelberg and Goldman, 1995
Figure 1. % change in platelet aggregation vs. cooking time. Hansen, Folts, and Goldman *In press*, 2012.
Pungency Paradox

- More pungent = more efficacy
- More pungent = more difficult to eat raw
- But cooking eliminates medicinal benefit
- So the best onion is the weakest onion
A Deep History and Connection
A Deep History and Connection

- Clear health benefits present
- Well documented through human history and modern science
- *The raw commodity is a value-added product*
- Though cooking and processing raises additional questions that should be addressed
- And clinically-relevant studies need to be conducted in order to fully assess the health value