How dangerous is your food?

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Ag Literacy Works

Really!
Told How Dangerous Food Is
But how dangerous is conventional food - really?
What is dangerous?

- Natural toxic chemicals in food?
- Toxic chemical residues from pesticides?
- Carcinogens? (cancer-causing agents)
- Microorganisms?
- Parasites?
- Allergens?
- Genetically Engineered Organisms?
- Hormones?
- Cloning?
Can we all agree?

- We want food to be as safe as possible.
- We especially want children’s food to be safe.
- We want to understand what that really means • objectively.
- We can use factual evidence to determine what is safe.
Where does danger really lie?
Is it a real danger?
Is the danger a marketing ploy?
Is the danger an activist ploy?
Who or what causes the danger?
Avoiding danger
Danger

- Is real …
  ...in some cases.
- Is perceived …
  ...in some cases.
- Is subjective …
  ...in some cases.
- Is manufactured …
  ...in some cases.
- Is hidden …
  ...in many cases.
Natural Toxic chemicals in food and beverages – dangerous?

- More dangerous than any other threat?
Toxic residues from pesticides in food and beverages – dangerous?

- 75% of all fruits and vegetables have no detectable residues
- Another 24.4% have residues well below the EPA tolerance.
Toxic residues from pesticides in food and beverages – dangerous?

- EPA sets tolerances at 100 times the amount that could potentially cause harm in mice.
- 99.4% are free from harmful residues.
- The 0.6% of those with residues at or above the EPA tolerance are investigated.
Plants and animals live in a dangerous world. Agree or Disagree?

Agree, it is a fact.
Animals can fight predators but plants cannot.

Agree or Disagree?

- Disagree
- Plants fight with spines, rinds and with self-defense chemicals.
Plants Use Complex Chemistry to:
- Kill Bugs, Fungi, Bacteria, Viruses
- To Fend Off Weeds
- Make Themselves Smell and Taste Bad
The dietary intake of nature’s pesticides are 10,000 times higher than the human intake of synthetic pesticide residues.
Many plants produce self-defense chemicals.

- These chemicals are plentiful and potent.
  - Allergens
  - Carcinogens (Cancer-causing agents)
  - Teratogens – (Cause birth defects)
  - Mycotoxins (Fungal Toxins)

- They have a long history of making people sick.
Natural Toxic Chemicals Produced by Plants (Plant Pesticides)

- Could not be registered if made by industry
- Too Toxic
- Too Plentiful
- Of all the vegetation in the world, we can eat very little
- Many plant toxins are heat stable
- Humans, other mammals, and insects have evolved special enzymes to detoxify foods.
You Can’t Leave the Plant out of Risk Analysis

- INSECTICIDE
- FUNGICIDE
- GENE MODIFIED
  • for INSECTICIDES
  • for RESISTANCE

- CULTIVAR
- WEATHER
- INSECTS
- FUNGI
- PESTICIDE RESIDUES
- NUTRIENTS
- ANTIOXIDANTS
- NATURAL TOXICANTS
- ALLERGENS
- MYCOTOXINS
Caffeine Pesticide Extraction

1. Roast Coffee Beans
2. Grind
3. Extract
4. Drink the Pesticide
5. Throw out the Beans
Chemicals Naturally Found in Coffee

- Benzo(a)pyrene
- Benzaldehyde
- Benzene
- Benzofuran
- Caffeic acid
- ethyl benzene
- 1,2,5,6-dibenz(a)anthracene
- Hydrogen peroxide
- Hydroquinone
- Hydroxycinnamic Acids
- 4-methylcatechol
- Furan
- Furfural
- Catechol
- d-limonene
- Cafestol
- Kahweol
- Anthocyanins
Arachic Acid
Aspartic Acid
Caffeoyl-3-Quinic Acid
Camoestanol
Campesterol
Caprinic Acid
Carnaubic Acid
Chlorogenic Acid
Cholestanol
Cholesterol
2-Ethylphenol
Galactan
Guaiacol
Guanosine
Isoeugenol
Lanosterol
M-Cresol
Mannan
O-cresol
O-xylenol
Oleic Acid
- Citrostadienol
- Coffeasterol
- Cycloeucalenol
- Gamma-Stiosterol
- Glucogalactomann
- Hydrogen-Sulfide
- Hypoxanthine
- Isochlorigenic Acid
- Lignoceric Acid
- Dihyfrolanasterol
- Dihydrositosterol
- P-Coumeric Acid
- Daturic Acid
- Alactomannan
- Myristic Acid
- N-Nonacosane
- Obtusipoliol
- Oxalic Acid
- P-Xylenol
- Palmitic Acid
- Pentosane
- Putrescine
- Raffinose
Citrostadienol
Coffeasterol
Cycloeucalenol
Gamma-Stiosterol
Glucogalactomann
Hydrogen-Sulfide
Hypoxanthine
Isochlorigenic Acid
Lignoceric Acid
Dihyfrolanasterol
Dihydrositosterol
Dimethyl-5-Alpha-Cholest-7-En-3-Beta-ol
Daturic Acid
Alactomannan
Myrisitc Acid
N-Nonacosane
Obtusipoliol
Oxalic Acid
P-Xylenol
Palmitic Acid
Pentosane
And...
- Dimethyl-5-Alpha-Cholest-7-En-3-Beta-ol
- Methyl-1-5-Alpha-Stigma-Beta-ol
- Rhamnose
- Saccarose
- Scopoletin
- Sinapic Acid
- Spermidine
- Squalene
- Stachyose
- Stearic Acid
- Tetracosic Acid
- Tannic Acid
- Tannin
- Theobromide
- Theophylline
- Trigonellinean
- Xanthine
- Xylan
But Coffee Also Has

- Antioxidants
  - Alpha-Tocopherol
  - Beta-Carotene
  - Beta-Tocopherol
  - Gamma-Tocopherol
- Polyphenols
- Calcium
- Carbohydrates
- Cellulose
- Choline
- Riboflavin
- Sugar
- Thiamine
- Citric Acid
- Cystine
- Dextrins
- Linoleic Acid
- Linolenic Acid
- Mannose
- Methionine
- Nitrogen
- Phosphorous
- Galactin
- Fat
- Iron
- Niacin
- Pectin
- Protein
An alkaloid $C_8H_{10}N_4O_2$
A chemical that prevents animals from eating the plant or its seeds.
A pesticide that repels insect attacks
Or kills insects that eat it
50 other plants have this same built-in protection
- Lemon
- Tea
- Cola
- Orange
- Grapefruit
- Cacao
Main side effects of Caffeine

Eyes:
- Blurred vision

Central:
- Drowsiness
- Decreased or increased hunger
- Thirst
- Anxiety
- Confusion
- Irritability
- Insomnia

Sense of balance:
- Dizziness

Skin:
- Flushing
- Cold sweats
- Pallor

Mouth:
- Dryness

Heart:
- Fast heartbeat

Respiratory:
- Fruit-like breath odor
- Troubled breathing

Intestinal:
- Diarrhea

Systemic:
- Hyperglycemia

Muscular:
- Tremor

Gastric:
- Nausea
- Ache

Urinary:
- Increased urination
- Ketones in urine
Humans are not alone

Bees will choose to pollinate a plant with caffeine over one without.
Natural carcinogens in food and beverages - dangerous?

- Present
- In what quantity?
How much carcinogen is in my food?

- Growth regulator no longer in use – Alar
- Bacon
- Tap Water
- Peanut Butter
- Diet Cola
- Mushrooms
- Beer
- Wine
Cancer Causing Chemicals

- Alar
- Bacon
- Tap Water
- Peanut Butter
- Diet Cola
- Mushroom
- Beer
- Wine

The graph shows the levels of cancer-causing chemicals in various substances, with Wine having the highest level.
Harmful microorganisms in food and beverages – dangerous?

- E. Coli 157:H7
- Salmonella
- Listeria
- Camplyobacter
- Botulism
Insect Damage Creates Ports of Entry for Fungi

from Hammond et al., SOT poster 2003
The Plant Is Damaged by Both the "Bug" and the Fungal Invasion

Damaged Fruits and Vegetables Are Cause For Concern

A Pest Makes a Hole in a Vegetable’s Wall

Fungi Invade the Hole

The Plant Is Damaged by Both the "Bug" and the Fungal Invasion

Fungi Make Mycotoxins A Growing Health Concern
**Example - Furocoumarins**

- Naturally found in many food plants:
  - Parsnips
  - Celery
  - Dill
  - Parsley
  - Grapefruit
  - Lemon
  - Lime
  - Orange
  - Potato
  - Carrots

  Plant chemical produced to fight a fungal invasion of the plant.
PARSNIP FUROCOUMARINS

FUROCOUMARIN DATA: UK MINISTRY OF AGRICULTURE, FISHERIES, FOOD. INHERENT NATURAL TOXICANTS IN FOOD. LONDON, 1996.
MYCOTOXIN WHEAT PRODUCTS -- ORGANIC VS CONVENTIONAL

Probabilistic Model – French Data
(amount eaten * contamination level)

"No human diet can be free of naturally occurring chemicals that are rodent carcinogens. Of the chemicals that people eat, 99.99% are natural."

Bruce Ames, Ph.D. and Lois Swirsky Gold, Ph.D. University of California, Berkeley
Parasites in food and beverages - dangerous?

- Giardia
- Cryptosporidium
- Toxoplasma gondii
- Trichinella
- Tapeworms
Most people claiming food allergies do not have allergies, they are intolerant of some component of the food.

**Actual Allergies -**

- Milk
- Eggs
- Fish
- Shellfish
- Tree Nuts
- Peanuts
- Wheat
- Soybeans
Genetically engineered components in food and beverages - dangerous?

- This is the most regulated technology ever developed.
- And after 20 years there have been no evidence of harm to people from GMO food.
Hormones in food and beverages – dangerous?
Manufactured Danger

Not Fed Hormones

Not Fed Hormones

Not Fed Hormones

Fed Hormones

Not Fed? Not Fed Hormones

Not Fed Hormones
Manufactured Danger

- Black Marketing

Fed Hormones?  
No Chicken is Fed Hormones
Black Marketing

- No Added Hormones
- Hormone Free
- rBGH Free
- Organic MILK
- Produced without Hormone
All milk tests exactly the same in the quantity and type of hormones found in it. It does not matter if the milk is produced organically, conventionally or from cows given rBST.
Components in foods and beverages that are from clones - dangerous?

Are there clones or components in the food system from clones?
What is a clone?

- A plant or animal genetically identical to the parent.
  - Cells in mitosis
  - Any organism that reproduces asexually.
Many weeds, trees, shrubs, ferns, vines and green plants form clonal colonies.

In horticulture, many plants are produced from a single individual to produce identical foliage, flowers and fruit.

Grafting is a type of cloning.
Which of these is never a clone?

- Potato
- Sweet Potato
- Garlic
- Wild Blueberry
- Asparagus
- Rhubarb
- Carrot
- Banana

Food and Nutrition: Agree or Fiction
Clones, clones, clones
Avoiding True Danger?

- Avoid Damaged Fruits and Vegetables
- Trim Around Wounds
- Keep Clean, Don’t Cross-contaminate
- Keep Cold Foods Cold
- Keep Hot Foods Hot
- Focus on Real Danger, Not Manufactured
Is real …
…in some cases.

Is perceived …
…in some cases.

Is subjective … or personal
…in some cases.

Is manufactured …
…in some cases.

May be where you least expect it – naturally!
Scared to Death

How Chemophobia Threatens Public Health

Presented by the

AMERICAN COUNCIL ON SCIENCE AND HEALTH

Written by Jon Entine
HOW PLANTS DEFEND THEMSELVES AND WHY THIS IS IMPORTANT FOR ANYONE THAT EATS FOOD

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June 2005