What is a Super Food?

• Certain plant foods have powerful anti-cancer and immune-enhancing effects
• Many of these healthful properties have only been discovered within the past 10 years
• For optimal health and Super Immunity: create meals in order to consume super foods in significant amounts and simultaneously
DNA Methylation and Cancer

- “Methylation” – modification of DNA by the addition of a “methyl group” – can alter the expression of the gene
- Not enough (hypomethylation) and too much (hypermethylation) both associated with cancers

5-Methylcytosine

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Dietary factors affect DNA methylation

• “Epigenetic” modification – change in gene expression caused by environment

• Leafy green vegetable intake was linked to reduced cancer-associated methylation in lung cells of former smokers
GOMBBS: Super Foods

- **Greens** and other cruciferous vegetables
- **Onions**, garlic, leeks, shallots, scallions
- **Mushrooms**
- **Beans** and other legumes
- **Berries**, pomegranate, and other fresh fruits
- **Seeds** and nuts
Cruciferous Disease Fighters

• Named for their flowers – four equally spaced petals in the shape of a cross

• Glucosinolates: sulfur-containing compounds that produce spicy/pungent flavors
The Cruciferous Vegetables

- Arugula
- Bok choy
- Broccoli
- Broccoli rabe
- Broccolini
- Brussels sprouts
- Cabbage
- Cauliflower
- Collards
- Horseradish
- Kale
- Kohlrabi
- Mustard greens
- Radish
- Rutabaga
- Turnip
- Watercress
Glucosinolates ➔ Isothiocyanates (ITCs)

- When cell walls are chopped/crushed/chewed the enzyme myrosinase is released; and converts glucosinolates to ITCs.

- ITCs are potent anti-cancer compounds.
Cancer-preventive actions of ITCs
ITCs work to prevent cancer initiation/progression

- Angiogenesis inhibition
- Antioxidant effects
- Anti-inflammatory effects
- Detoxify carcinogens
- Prevent carcinogen-DNA binding
- Promote repair of damaged DNA
- Promote death of cancerous cells (apoptosis)
- Promote excretion of estrogens (DIM and I3C)
Cruciferous vegetable consumption and cancer risk

• Cruciferous vegetables are more powerful than other plant foods.

• Example:
  – 28 servings of vegetables/week decreased prostate cancer risk by 33%
  – Only 3 servings of cruciferous vegetables/week decreased prostate cancer risk by 41%
Antiviral, antibacterial properties of cruciferous vegetables

• I3C and DIM stimulate cell-killing activity of immune cells
• DIM resolves cervical dysplasia, being studied as a treatment for HPV, HIV, and other viral infections
• ITCs increase resistance against infection by drug-resistant bacteria
• ITCs inhibit *H. pylori* growth
The Nrf2 detoxification system

- Nrf2: transcription factor
- Regulates genes that code for detoxification enzymes
- Responds to acute stresses
- Also activated by antioxidants and ITCs

➔ Detoxification proteins are produced in our cells when we eat green vegetables

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Nrf2 system protects blood vessels

- Branch points (bifurcations) in arteries are prone to plaque formation
- SFN activates Nrf2 and decreases adhesion molecule expression: prevents inflammatory cells from binding to endothelial cells at bifurcations and stress points

➔ Green vegetable-fueled Nrf2 activity prevents an early event in cardiovascular disease
Cruciferous greens and intestinal lymphocytes

- AhR maintains lymphocyte populations in skin and intestine
- Cruciferous phytochemicals promote AhR activity
- Lack of AhR activity compromises resistance to microbes
Maximizing the benefits of cruciferous vegetables

• We get the most benefit from raw – eat some cruciferous vegetables in salads.
• Chew VERY well – try to crush every cell
• Blend or chop raw cruciferous vegetables before cooking
• When steaming, undercook slightly
• Aim for two cruciferous vegetable servings per day (one raw and one cooked)
Life-saving Mushrooms

• Mushrooms have uniquely potent immune-enhancing effects
• Empower the body to react quickly and powerfully to disease-causing pathogens
• May be helpful for auto-immune disease because of their immune-modulating, anti-inflammatory properties
• Mushrooms protect against cancer by several mechanisms
Aromatase inhibitors and breast cancer

• Women who ate 10 g mushrooms/day had a 64% decrease in breast cancer risk
• Mushrooms + green tea: 82-89% decreased risk
• Mushrooms are uniquely protective against breast cancer because they contain aromatase inhibitors
• Aromatase = enzyme that produces estrogen
• Currently, there are cancer drugs on the market that are designed to inhibit aromatase
• We can get natural aromatase inhibitors in our diet by eating mushrooms regularly
Additional anti-cancer effects of mushrooms

White, cremini, portobello, oyster, maitake, shiitake, and reishi mushrooms all have anti-cancer actions, including:

- Enhancing activity of NKT cells
- Contain lectins that bind to abnormal cells to activate the body’s defenses
- Prevent DNA damage
- Slow tumor growth
- Cause apoptosis of cancerous cells
- Inhibit angiogenesis
Angiogenesis:
formation of new blood vessels from previously existing ones

• Small tumors send angiogenic signals
• Endothelial cells respond to the signal:
  – Sprout
  – Divide
  – Form tubes
  – Mature into new vessels

➔ The tumor now has its own blood supply
➔ Tumor growth

• Several cancer treatments are designed to block angiogenesis
• Natural angiogenesis inhibitors in many plant foods
Natural Angiogenesis Inhibitors

Body fat and tumors inhibited
Mushrooms, onions, garlic, soy, cinnamon, berries, greens

Body fat and tumors promoted
Angiogenesis is activators
Insulin, steroids, sweets
Onions and Garlic: Anti-cancer and Immunity-building super foods

• The *Allium* family of vegetables is both flavorful and healthful

• Contain organosulfur compounds with anti-cancer and anti-inflammatory effects

• Onions are rich in flavonoid antioxidants that fight cancer and inflammation

• Like cruciferous vegetables, *Alliums* MUST be chopped before eating or cooking to initiate the chemical reaction that forms the organosulfur compounds
Multi-country study of *Allium* consumption and cancer

Those who ate about ½ cup/day or more had dramatic reductions in cancer risk:

- 56% reduction for colon cancer
- 73% reduction for ovarian cancer
- 88% reduction for esophageal cancer
- 71% reduction for prostate cancer
- 50% reduction for stomach cancer
How to Cut an Onion

• Make sure that the onion is cold before you cut it. Even putting the onion in the freezer for 5 minutes is sufficient.
• You can use a fan to blow the gaseous compounds away from you.
• The root is the part of the onion with the highest concentration of these compounds.
Pomegranates and Berries: Superheroes in Disguise

• Pomegranate has protective effects against cancer, cardiovascular disease, diabetes, erectile dysfunction, bacterial infections and antibiotic resistance, UV-induced skin damage

• All berries are rich in colorful phytochemicals, anthocyanins in particular, that fight cancer.
Recent Research on Pomegranate

• Cancer:
  – Inhibits tumor cell proliferation, invasion, and angiogenesis
  – Inhibits progression of breast cancer, prostate cancer, colon cancer, leukemia. Has anti-aromatase activity

• Heart disease:
  – Inhibits ACE – naturally lowers blood pressure (Note angiotensin promotes angiogenesis)
  – Pomegranate antioxidants reverse atherosclerosis, reduce excessive blood clotting. Reduction in atherosclerotic plaque in humans – 1 ounce/day for 1 year

• Depression:
  – Contains compounds that stimulate serotonin and estrogen receptors, improving depression symptoms and building bone mass

• Infections:
  – Reduces tissue damage and infections in those with kidney problems
Pomegranate extracts reduce atherosclerotic plaque size
How to Open a Pomegranate

• Cut around the center and twist open
• Hold half cut-side down over a large bowl
• Use a heavy wooden spoon to bang every inch of the pomegranate
• The seeds will fall into the bowl
Berries are rich in ellagic acid

- 1980s: scientists found that ellagic acid (an antioxidant) inhibited tumor formation
- They then found that berries (especially black raspberries) are markedly high in ellagic acid
- Sparked interest in berries as an anti-cancer food
Anti-cancer effects of berries

• Inhibit angiogenesis, reduce inflammation
• Blackberries reversed DNA damage in rats after exposure to a carcinogen
• Reduce breast tumor size and development in mice
• Many animal studies cite reductions in cancer occurrence with exposure to berry extracts
• Recent human study: In patients with precancerous esophageal lesions, freeze dried strawberries slowed/reversed progression of these lesions into cancer
More big benefits of berries

• Reduced risk of diabetes, cognitive decline
• Improve learning and memory in older adults
• One serving/week of blueberries reduced risk of hypertension 10%
Seeds: A New Door to Great Health

• Although they are high in fat and protein, they promote health (unlike animal foods)
• Similar health benefits to nuts, plus unique nutritional profiles
• Higher in protein than nuts
Dietary lignans enhance survival of women with breast cancer 10 year survival

<table>
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<th>Dietary Lignans (mg/day)</th>
<th>% Risk reduction – all cause mortality</th>
<th>% Risk reduction – breast cancer mortality</th>
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<tr>
<td>0 – 0.155</td>
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<td>0.227-0.318</td>
<td>22%</td>
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<tr>
<td>&gt; 0.318</td>
<td>51%</td>
<td>71%</td>
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</tbody>
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One tablespoon of flaxseed contains 21.4 mg lignans!
Nutritional profiles of seeds

Flax seeds:
- Omega-3s
- Fiber
- Lignans – anti-breast cancer effects

• Sunflower seeds:
  - Mineral-rich
  - 22% of calories from protein
  - Rich in tryptophan

• Pumpkin seeds
  - Rich in zinc, calcium, iron

• Sesame seeds:
  - Highest calcium of any food
  - Full spectrum of vitamin E fractions
  - Lignans

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Top Super Foods for Super Immunity

- Kale/collards/mustard greens
- Arugula/watercress
- Green lettuce and cabbage
- Broccoli and brussel sprouts
- Carrots and tomatoes
- Onions and garlic
- Mushrooms
- Pomegranates
- Berries
- Seeds