Session 1: Defining Functional Foods and the Free Radical Theory

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Nutrition and You: Functional Foods

Course Objectives

Students will be able to:

1. Define functional foods.
2. Name several examples of functional foods.
3. Identify functional food trends.
4. Demonstrate understanding of how functional foods are regulated by the FDA.
5. Demonstrate understanding of antioxidant properties.
6. Define the Free Radical Theory.
7. Develop an opinion on how functional foods may be included in the diet.

Outline

- What Are Functional Foods? Why are they important?
- Risks, Research and Regulations
- Antioxidants and the Free Radical Theory
- Should Functional Foods be Included in Your Diet?

What are Functional Foods?

What are Functional Foods?

- No legal or regulatory definition in the US.
- Is the term a marketing tool? All food is functional if it provides energy that nourishes life.
- Murky definition and regulatory status = increased importance of an educated consumer!
- At least 7 definitions, all very similar, from various and international groups specializing in food or health.

Academy of Nutrition and Dietetics (AND) Definition:

- "Foods defined as whole foods along with fortified, enriched, or enhanced foods that have a potentially beneficial effect on health when consumed as part of a varied diet on a regular basis at effective levels."

AND. Position of the Academy of Nutrition and Dietetics: Functional Foods. *J Acad Nutr Diet*. 2013; 113(8)

Snippets from other definitions of "Functional Food":

- Contains components or ingredients that provide a health benefit beyond basic nutrition. (Institute of Food Technologists, IFIC, Health Canada)
- Food with an ingredient "officially approved to claim its physiological effects on the body." (Japanese Ministry of Health)
- A food that is "part of a normal food pattern" (European Commission)

A Functional Food is NOT:

- A nutraceutical: these may be found in pill form (nutritional supplements) where as functional food is food. A functional food may be made with ingredients considered to be nutraceuticals.
- Medical food prescribed and overseen by a physician to treat a disease or condition with specific nutritional requirements, such as phenylaline-free formula for patients with patients with phenylketonuria.

(August 2013) Position of the American Dietetic Association: Functional Foods

Functional Foods: Not a New Thing

- Functional foods have been around for nearly a century:
  - Salt was fortified with iodine beginning in the 1920s.
  - Milk was fortified with vitamins A and D beginning in the 1930's.

BMJ Functional foods: the case for closer evaluation 2007;334:1037-1039 (19 May)

Examples of Functional Foods:

- Whole foods that are promoted on the basis of their naturally occurring nutrient or antioxidant content. Most vegetables, fruits, meats, dairy, fish, and grains contain natural bioactive compounds that have health benefits.
- Foods that are promoted because of their higher levels of certain compounds.
  - For example milk as a source of calcium, tomato products as a source of lycopene and other carotenoids, spinach for its lutein

Source: AND. Position of the Academy of Nutrition and Dietetics: Functional Foods. *J Acad Nutr Diet*. 2013; 113(8)

Probiotics vs. Prebiotics

- **Pro**biotics are fermented dairy products like Kefir Milk that contain live cultures of bacteria which are claimed to “improve the microbial balance of the body” and thus reduce the risk of certain infections.
  - Yogurt, Kefir Milk, Probiotic supplements
- **Pre**biotics are non-digestible food ingredients that are said to promote the growth of certain bacteria within the body and thus to beneficially change the microbial balance of the body in a similar way to probiotics.
  - Asparagus, Bananas, Chicory Root, Jerusalem Artichokes, Leeks, Garlic, Onions, Kimchi, Wheat Bran, Miso, Sauerkraut, Inulin

American Journal of Clinical Nutrition, Vol. 71, No. 6, 1682S-1687s, June 2000
Diabetes Care and Education 2009

Examples of Functional Foods:

- Foods fortified with specific nutrients or antioxidants with the aim of providing specific health benefits:
  - Calcium and vitamin D enriched drinks, such as fortified OJ, to promote bone health
  - Food fortified with folic acid to prevent neural tube defects in newborns, such as fortified cereals
- Foods enriched with omega-3 fatty acids
  - Eggs and milk with increased omega-3 (DHA and EPA) content from manipulating the diet of hens
  - Learn more about omega 3's: http://www.superkidsnutrition.com/nutrition-articles/nutrition_answers/meal_tips/meal-tips/mt_parents-omega-3/

Examples of Functional Foods:

- Foods marketed as “Low-Calorie”
  - Sugar is substituted with stevia, sugar alcohols, or calorie-free artificial sweeteners such as saccharin, aspartame. Check out www.cspinet.org and search chemical cuisine for updates on food additives.
- Foods containing synthetic and indigestible fats
  - Olestra, same taste and mouth-feel of natural fat
  - Olestra is not digested or absorbed
  - Originally intended as weight management tool, now being studied for its potential to reduce fat-stored toxins, such as PCBs (Jandacek et al, 2014).
  - It’s recommended to avoid olestra due to gastrointestinal side effects and loss of fat soluble carotenoids.

Jandacek RJ, Heubi JE, Bucklet DD et al. Reduction in body burden of PCBs and DDE by dietary intervention in a randomized trial. *J Nutr Biochem.* 2014; 25:483-488.

Examples of Functional Foods:

- Margarine and other products with high levels of certain plant sterols.
  - Phytosterols and phytostanols which inhibit the absorption (and the re-absorption) of cholesterol in the gut and thus can lower blood cholesterol levels without effecting HDL.
    - More to come on plant sterols.
    - Choose margarines that are high in olive oil, canola oil or reduced fat milk is used for the butter (lite butter)
    - If you're concerned about palm oil and deforestation, choose brands that note they use sustainable palm oil.

Examples of Functional Foods:

- Foods and supplements which have high levels of phyto-estrogens.
  - These are a group of phytochemicals (plant based chemicals in foods) that mimic the action of the female hormone estrogen and have been claimed to have benefits for both relieving some symptoms of menopause and preventing hormone-dependent cancers. (studies are limited)
- Sterols and stanols are found in small amounts in a variety of plan foods including grains, vegetables, legumes nuts and seeds.

Functional Food, Slippery Slope?

- Something to think about:
  - Companies that make sports drinks claim that the electrolytes and the “carbohydrate sugars” in their drinks are “functional” as they fuel athletes.
  - Energy drinks may make the same claim.
  - If these drinks are functional among certain groups, does that make them healthy for everyone?
  - Cool tip –sprinkle salt on cantaloupe and you have an effective electrolyte replacement

Evaluating Functional Foods, Guiding Questions:

- Brophy and Schardt identified four guiding questions to evaluate functional foods on a case by case basis:
  - **Does it work?** Quality research is needed to support any health claims, and in many cases, health claims are based on theory and not reputable research. In some cases research is available, but only with certain groups of individuals, not the general population.
  - **How much does it contain?** Some food products contain only a fraction of the amount that may be beneficial.

Nutrition Action Health Letter

Evaluating Functional Foods, Guiding Questions:

- **Is it safe?** Unfortunately, many ingredients used in functional foods need not undergo strict governmental testing for approval.

- **Is it healthy?** Although there may be some healthful benefits of added nutrients to foods, such as calcium-fortified orange juice, creating a calcium fortified orange drink with sugar and water is much less healthful.

- These same four questions may be directed to evaluate the benefits of dietary supplements, which are the purportedly active ingredients in functional foods.

From Nutrition Action Health Letter (www.cspinet.org)

Functional Foods Market is BOOMING!

- Global market is estimated at $130 billion dollars

AND. Position of the Academy of Nutrition and Dietetics: Functional Foods. *J Acad Nutr Diet*. 2013; 113(8)

Trends in Functional Food:
Pay the Grocer, Not the Doctor

- Faced with expensive health-care costs, Americans may be driven towards functional foods to “self-treat” health problems.
- The aging population and obesity epidemic are two other factors driving functional food trends.
- Functional foods give individuals opportunity to take control of their own health.

Position of the Academy of Nutrition and Dietetics: Functional Foods. 2013; 113(8):1096-1103.

Trends in Functional Food:
Old School vs New School

- In the 80s and 90's the marketing emphasis of processed food companies was subtracting "unhealthy" ingredients, such as fat or sugar.
- Still today manufacturers often replace fat with:
  - Sugar
  - Salt
  - Chemical fillers
  - Adds flavor, texture, and mouth-feel back into foods that have been stripped of fat
  - Often better to choose the full fat version for foods such as peanut butter
- More recently, the trend is to add beneficial ingredients to processed food and convince consumers of the benefits.

Trends in Functional Food:
What can my food do for me and my family?

- According to Food Technology Magazine, effort by consumers, especially mothers, to choose food that has enhanced health benefits was a Top Ten Trend.
- About a third of food shoppers say that heart issues and preventing cancer were important in their food selections.
- One-third of shoppers want ingredients in their food purchases that will help them control blood sugar.
- The article described monounsaturated fatty acids, pre and probiotics and anthocyanins and reservatrol as having "untapped mass market opportunity".

Sloan AE. Top Ten Food Trends. *Food Technology*. 2013;67(4)

Trends in Functional Food: What can my food do for me and my family?

- In 2012, 78% of consumers made a strong effort to get more vitamins, 57% made a strong effort to consume more products with specialty nutritional ingredients, 45% herbs/botanicals, and 42% minerals (MSI, 2011c).
- One-third of consumers would like more ingredients to help balance blood sugar (NMI, 2012).
- In 2012, 37% of shoppers said heart issues were very important in their food selections, followed by preventing cancer, which 32% considered very important; the need for more energy 29%; digestive health 29%; improving immunity 26%; building physical strength 25%; and bone density 27% (FMI, 2012).

Trends in Functional Food: What can my food do for me and my family?

- Moms are more likely than shoppers overall to buy nutritionally enhanced food/drinks (46% vs 39%) and to actively seek out nutritional information/guidelines (61% vs 56%).
- They are significantly more likely to buy products with a high fiber or calcium claim and about as likely as the overall population to buy low-/no-fat items (Packaged Facts, 2013b).

Risks, Research and Regulations

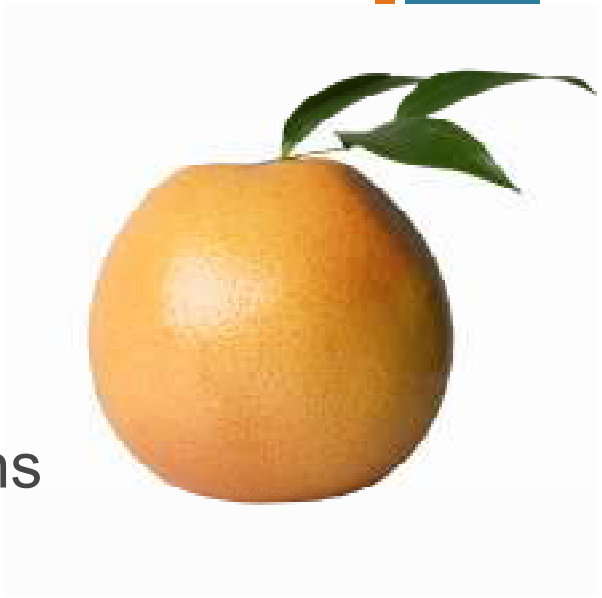
Functional Foods

Functional Food
Risks

- Functional foods may exceed safe upper levels of certain vitamins/minerals or phytochemicals.
  - On the days you eat an "energy bar" you may want to skip your multivitamin.
  - Read the food label, the ingredients and the percent daily value
- Enriched food may be beneficial for one group of people, but detrimental to others.
  - Added Iron may be great for women of child-bearing age, but harmful to those with genetic iron-overload disorders such as hemochromatosis.
  - Be cautious of making generalized recommendations with functional foods.

Functional Food **Risks**

- Bioactive components may interact with medicines in ways that research has not yet elucidated.
  - Furanocoumarins in Grapefruit and some statins
  - Vitamin K, found in green, leafy vegetables and Warfarin.
- Individuals could develop allergic reactions to particular ingredients.
- Quackery: Consumers could waste money on foods believed to offer benefits or cures that do not exist.



Pronsky ZM, Crowe JP. Food Medication Interactions. (2012)
Food-Medication Interactions: Birchrunville

Regulation:
Federal Food, Drug, and Cosmetic Act of 1938

- Functional foods are regulated as conventional foods and governed under regulations that apply to all foods.
- All ingredients must be considered GRAS (generally recognized as safe) or the manufacturer must conduct and submit research to the FDA determining the ingredient's safety.
- Info-graphic: https://www.cspinet.org/foodsafety/gras.html\
- **When a link does not work, the website may have changed its internal url. Please go to google search, type in the general website, for example cpsinet.org (space) and the topic (food safety GRAS). These change so often, it's not possible to update.

Nutritional Labeling and Education Act of 1990

Four categories of claims:

- Nutrient content claims
- Structure / function claims
- Health claims
- Qualified health claims

A functional food may have all four types of claims.

FUNCTIONAL FOODS: Nutrient Content Claims

- Food processors are permitted to describe the nutrient content of the food using terms such as “free”, “high” or “low” as long as the claims are in accordance with the FDA’s regulations.
- Example: A food may be labeled, “High”, “Rich In”, or “Excellent Source Of” a nutrient only if a customarily consumed amount contains 20% or more of the daily value.
- For more information: FDA.gov

FUNCTIONAL FOODS: Structure / function claims

- An ingredient or nutrient in the food has a role in the healthful functioning of the body. Some examples:
  - "Calcium builds strong bones"
  - "Antioxidants maintain cell integrity"
  - "Fiber maintains bowel regularity"
- Or, a particular nutrient or ingredient in the food has a role in general well-being, or prevents a nutrient deficiency disease. If it prevents a deficiency disease, claim must state how common that deficiency is in the US.
- These health claims do not need approval from the FDA (rules for dietary supplements are more stringent).

http://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm111447.htm
accessed April 2015

FUNCTIONAL FOODS: Health Claims

- Claims are authorized by the FDA after thorough review and strong consensus of scientific evidence, or after a statement from a scientific body of the US government or National Academy of Sciences.
- Altogether, there are 16 approved health claims. This number may change annually.
- Example: “25 grams of soy protein a day, as part of diet a low in saturated fat and cholesterol, may reduce the risk of heart disease. A serving of [name of food] supplies __ grams of soy protein.”
  - To have this claim, the food must contain at least 6.25g soy protein per RACC (recommended amount customarily consumed) and be low in saturated fat, low in cholesterol, and low fat (except foods made from whole soybeans which contain no fat in addition to that inherent in the soybean).

FDA.gov accessed April 2015

FUNCTIONAL FOODS: Qualified Health Claims

- If scientific consensus is not strong enough for a Health Claim, the FDA may approve a health claim with specific "qualifying" language that must be used to avoid misleading the public.
- Example: "Green tea may reduce the risk of breast or prostate cancer although the FDA has concluded that there is very little scientific evidence for this claim."
- Check out www.aicr.org for more on green tea

Regulation:

The Dietary Supplement Health and Education Act (DSHEA)

- The Dietary Supplement Health and Education Act (DSHEA) of 1994 exempts dietary supplements from the stringent approval required for foods and food additives.
  - For supplements, the manufacturer makes the determination if the ingredient is safe and no approval is needed from the FDA, and the FDA does not have authority to conduct reviews of the product's safety.
  - Once that ingredient is added to a food, the ingredient must either be determined as GRAS or undergo the approval process of a food additive.
  - FDA seeks to ensure that a functional food is not a conventional food that has a supplemental ingredient added to it that may be unsafe in general, or unsafe to specific populations, for example, children.

Regulation:

DSHEA Cont.

- Manufacturers sometimes try to get around food regulations by marketing food as dietary supplements.
- Dietary supplements can market claims that don't need the FDA's approval.
- In 1999, Hain's marketed "Kitchen Prescription" soups as a dietary supplement. The supplements contained St. John's Wort or Echinacea, which purport to improve mood or immunity, respectively.
  - The FDA notified the manufacturer that these soups are not legitimately dietary supplements and must not be sold and labeled as such because the products clearly represent conventional foods.

FDA –Functional Foods

- The FDA has issued warning letters to the industry when botanicals and other novel ingredients in conventional foods have not met the requirements of the generally recognized as safe (GRAS) provisions.
- For example, cholesterol-lowering margarines were initially marketed as dietary supplements until the FDA informed the manufacturer that the plant stanol esters contained in the product were considered unapproved food additives.
- The product's manufacturer was required to demonstrate to the FDA, through sufficient scientific documentation, that these additives were GRAS before the product could be marketed as a food in the United States.
- *These products will be discussed in Week 3*

http://www.fda.gov/

Research Opportunities:

- Many bioactive ingredients have been studied in laboratory apparatus. These are called *in vitro* studies. Although these studies can provide us with hypotheses, *in vivo* studies are needed to establish the bioavailability and efficacy of bioactive ingredients in humans when consumed in food.

AND. Position of the Academy of Nutrition and Dietetics: Functional Foods. *J Acad Nutr Diet*. 2013; 113(8)

Research Questions:

- Bioavailability: Is your body able to absorb and use the ingredient?
  - Bioavailability depends on how the ingredient interacts with other ingredients in the food, other components of the diet or meal, and genetically determined differences between individuals.
- If ingredients are bioavailable, do they have the desired beneficial effects at the quantities typically eaten?
- If it is efficacious, are there undesirable side effects?
- Is there an upper limit of consumption, after which the ingredient becomes toxic?
  - Go to SuperKidsNutrition.com and search the Real Truth About Cinnamon for an example of upper limits related to a food substance

Safety of Functional Foods

- More information regarding regulations and safety of supplements and functional foods is discussed in the Course: Public Nutrition and Wellness Education and in my other courses, Smart Nutrition: Healthy Eating for all Generations and Advanced Nutrition: Super Foods for the Family.
- Learn more about these at melissashealthyliving.com

More examples of functional foods….

11 could use bigger, more beautiful pictures if available

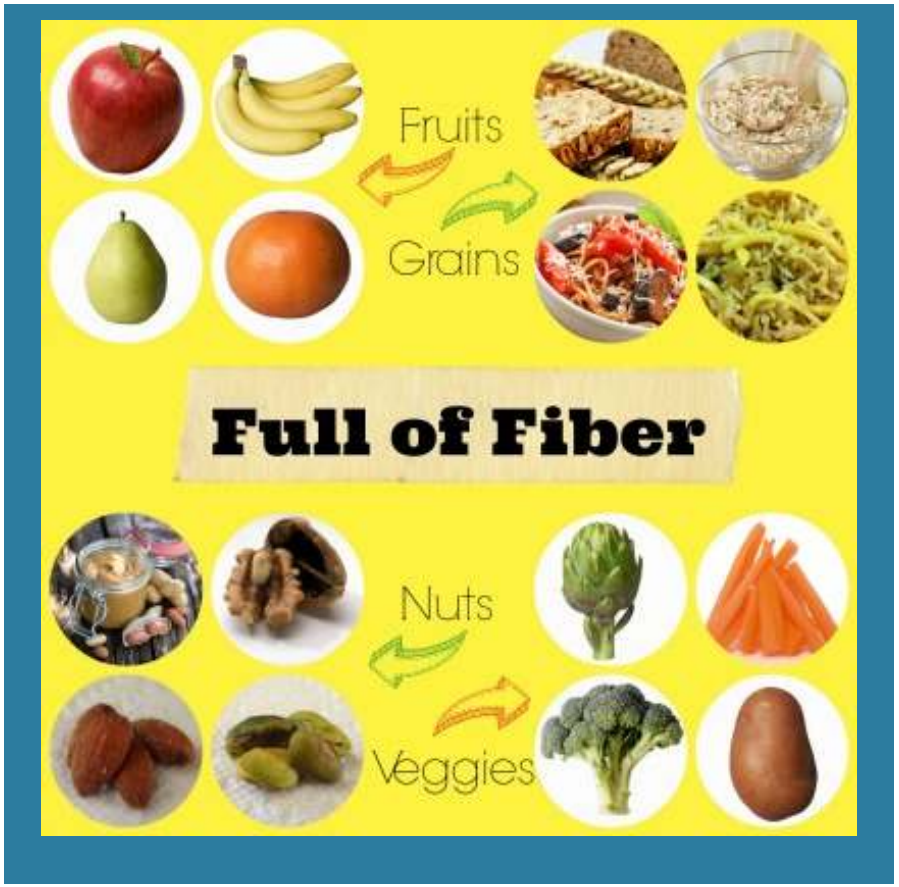
Brooke Sinclair, 6/11/2012

Functional Foods Defined: Fruits and Vegetables

- There is overwhelming epidemiological evidence that diets rich in fruit and vegetables are associated with reduced risks of cancer, heart disease and other degenerative diseases associated with aging.
- Although current has shown a shift away from demonizing saturated fats, the vast majority of experts still emphasize a diet rich in whole real foods.
- Generally recognized that the association is causal: that fruits and vegetables help prevent these diseases. It could also be that these foods provide bulk, increase satiety are associated with a lower body mass index.

Functional Foods Defined: Fruits and Vegetables

- Many officially sponsored health promotion campaigns and nutrition websites encourage higher consumption (at least five servings per day) of fruits and vegetables [like eat more fruits and veggies]
- http://www.superkidsnutrition.com/nutrition-articles/nutrition_answers/fruits_vegetables/
- http://www.fruitsandveggiesmatter.gov/
- http://www.aicr.org (American Institute for Cancer Research)



Antioxidants and the Free Radical Theory

Functional Foods

Fruits & Vegetables and Antioxidants

- One explanation for this presumed causal association between fruits and vegetables and certain diseases:
  - The high antioxidant content of fruits and vegetables is responsible for at least some of the reduced risk of chronic disease (degenerative changes) associated with eating the recommended servings.
  - In addition these foods are not pro-inflammatory. They take the place of highly processed foods that are high in omega 6 fatty acids, sugar and refined flour commonly found in the American diet that increase inflammation.
    - To learn more see http://rheumatoidarthritis.net/nutrition/real-deal-omega-3-omega-6/

American Journal of Clinical Nutrition, Vol. 81, No. 1, 298S-303S, January 2005

Antioxidants

- Antioxidants and antioxidant systems prevent acute damage to health by quenching the oxidative free radicals that can damage cellular components.
- It is widely accepted that chronic degenerative diseases such as cancer, atherosclerosis, cataracts and even aging may be the result of cumulative oxidative damage to cellular components.

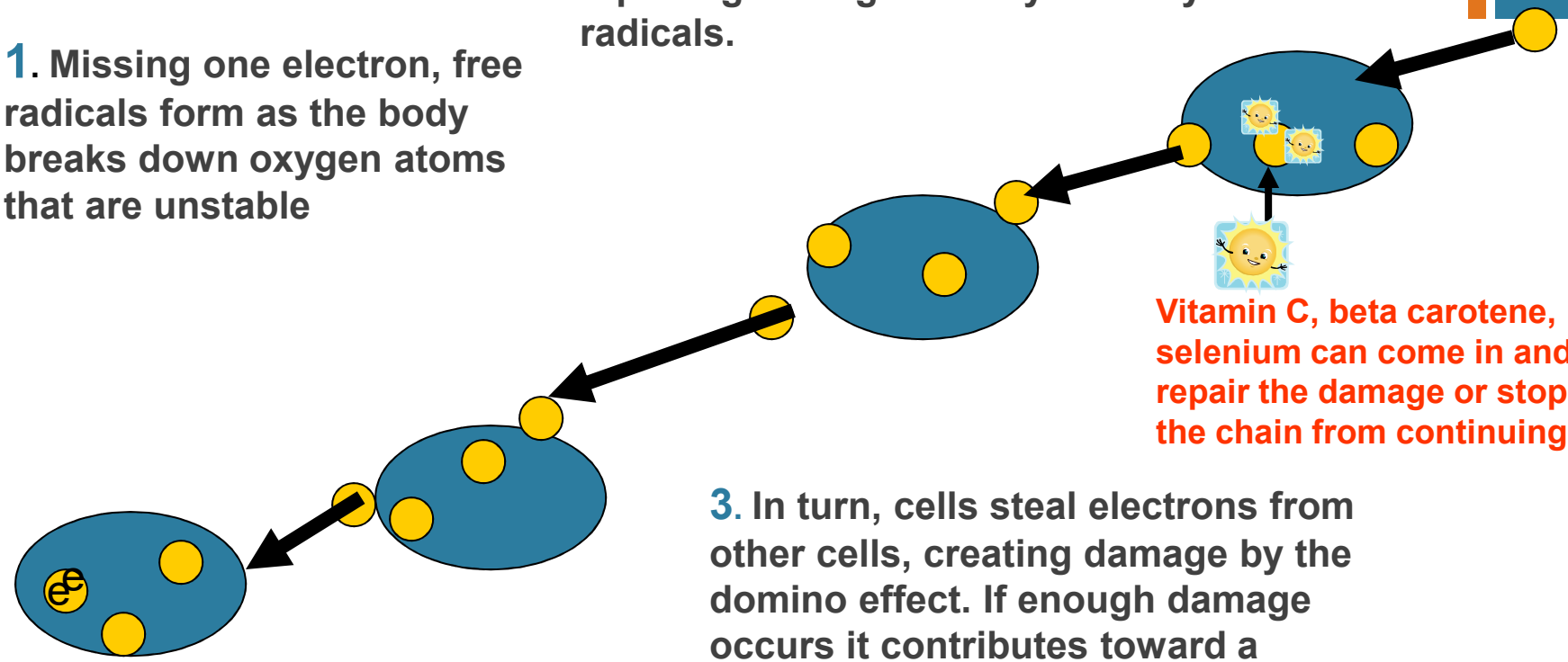
Have you tried roasting your garlic?

How Antioxidants Work in Theory

Electron
DNA

1. Missing one electron, free radicals form as the body breaks down oxygen atoms that are unstable

4. Antioxidants can stop the damage either by stabilizing free radicals or repairing damage already done by free radicals.



Vitamin C, beta carotene, selenium can come in and repair the damage or stop the chain from continuing

3. In turn, cells steal electrons from other cells, creating damage by the domino effect. If enough damage occurs it contributes toward a disease process. Free radicals oxidize, or damage other cells through the body accelerating the aging process.

2. Trying to achieve stability, free radicals steal electrons from cells within the body, creating a "hole" or cell damage.

How Nutrition Works, Kristine M.Napier, MPH, R.D

What's the deal with Free Radicals ?

- Oxygenation occurs every day as we breathe in oxygen to live and survive.
- Free radicals can cause breaks in the DNA chain and also cause base changes.
  - These mutations might initiate carcinogenesis (the beginning of cancer).
- Free radicals or reactive oxygen species are highly reactive chemical entities that are produced as by-products of the normal oxidative processes in cells.

J. Nutr. 134:3143S-3163S, November 2004

What's the deal with Free Radicals ?

- *The science of free radicals:*
  - Short lived form of compounds that exist with an unpaired electron, causing it to seek an electron from another compound.
- Antioxidants may prevent the damaging effect of unstable oxygen – they quench its thirst and neutralize the oxygen!
- Vitamins C and E are the two must abundant and effective dietary antioxidants in humans –this does not mean you should take these as supplements

Peroxidation

- Peroxidation of polyunsaturated fatty acid residues in membranes can lead to major impairment of membrane function.
- A more concrete example: When you leave out butter, it becomes rancid. The peroxidation of the fat (lipids) in the food creates a horrible flavor and if you eat the rancid fat it becomes incorporated into cell membranes.
  - This is why as a Registered Dietitian I tell clients to avoid deep fried foods, especially when eating out. The oil is not frequently replaced and is highly oxidized. These fats, such as those in French fries, get incorporated into your cell membranes.
  - When doing restaurant inspections in the past, I noticed that the deep fryers often had oil as dark as chocolate brown (this oil is completely oxidized!)

Peroxidation

- Now that you understand peroxidation –
- Think about this…..
- The most consumed vegetable by America's children is French Fries!
- **Doughnuts**
  - Contain trans fats, sugar, refined flour, fat (from deep frying), 300 empty calories and are likely peroxidized!

More on Oxidation

- Oxidation of polyunsaturated fatty acid residues in low-density lipoprotein (LDL) cholesterol can increase its potential to induce arteriosclerosis and increase the risk of cardiovascular diseases.
- Remember the fats that you eat become part of you. They are incorporated into your cells. All the nutrients you take in become incorporated at a cellular level!

YOU ARE WHAT YOU EAT!


When I learned, 'You are what you eat', I realized I was nuts.
THERAPY

More on Oxidation

- For example: Hyaluronic acid is a complex polysaccharide found in connective tissue and synovial fluid which acts as a lubricant in joints.
  - Free radicals can degrade hyaluronic acid and inflammation leads to reduced amounts of synovial fluid in joints.
  - It is suggested this may be the result of free radicals produced by neutrophils at the site of inflammation.

Oxidation: Review the Facts

- Reactions of free radicals involve their gaining or donating an electron
- These reactions produce another unstable product with an unpaired electron which is also highly reactive – a potential to initiate damaging chain reactions
- Unless this chain is broken and the free radical is quenched, damage can occur

The Free Radical or Oxidant Theory of Disease

- Fruits and vegetables are concentrated sources of many antioxidant compounds.
- Flavonoids and other phenols and polyphenols found in foods such as grapes, nuts, many other fruits, green tea, olive oil, chocolate and red wine have antioxidant properties.
- Fruit and vegetable consumption is consistently associated with reduced risk of cancer and heart disease which may be due their varied and plentiful antioxidant content.

Free Radical Damage

- Free Radical damage may increase degenerative changes which may present as cancer, heart disease, retinopathy, arthritis or simply more rapid aging.
- A diet that is low in one or more of the vitamins and minerals that are essential components of the physiological mechanisms for quenching free radicals, such as vitamin E, vitamin C, selenium, or zinc, could put one at risk for these degenerative changes.

Free Radical Damage

- A diet that is low in the other plant chemicals that are not recognized as essential nutrients (such as vitamins, minerals, essential fatty acids), may be essential for maintaining health and longevity. We are still discovering the benefits of various phyotchemicals.
  - Useful antioxidants such as the carotenoids, flavonoids and other polyphenols could be considered Super Nutrients!
  - These will be discussed later.

Free Radical Damage

- Genetic defect or predisposition in one of the physiological antioxidant or repair mechanisms may also lead to accelerated production of free radicals.
  - The Human Genome Project will help with enhanced learning of this theory.
- Exposure to environmental factors that accelerate free radical production include: heightened sun exposure, tanning beds, cigarette smoking, certain chemical agents, or exposure to other ionizing radiation.
- Infection, injury or any noxious stimulus that contributes to (chronic) inflammation and thus to increased generation of free radicals by the white cells that infiltrate the area in response to the inflammatory stimulus.

Handbook of Nutraceuticals and Functional Foods, 2nd edition, edited by Robert EC Wildman CRC Press

Free Radical Damage

- Diet is a controllable factor that can have a huge impact on disease prevention and longevity.
- Choose to eat well, commit to a healthy diet! Aim for a diet abundant in whole foods, lower in sugar and refined grains high in plant based foods. Feel better and live better!
- Create good nutrition habits from the start of life by modeling good food and health behaviors!

Antioxidant supplements?

- Not so fast!
- A large number of nutritional intervention trials using the antioxidants b-carotene, vitamin A, vitamin C, vitamin E and selenium have shown no obvious effectiveness in preventing gastrointestinal cancer or in lengthening mortality
  - Certain antioxidants were linked to an **increased risk of death**, in some cases by up to 16 percent.
- It's about having the right mix of endogenous and exogenous antioxidants!
  - Supplements can shift the balance towards too much of certain antioxidants

Antioxidants & Supplementation

- More isn't always better – as with super powerful antioxidant vitamin and mineral supplements. For example, just enough sun can boost production of needed vitamin D to help prevent osteoporosis –but too much sun exposure increases the risk of cancer. The right amount of vitamin A protects your bones –but too much increases the risk of fracture.

- For example: Bleach on your clothes – too much can make a hole, just the right amount brightens it perfectly!

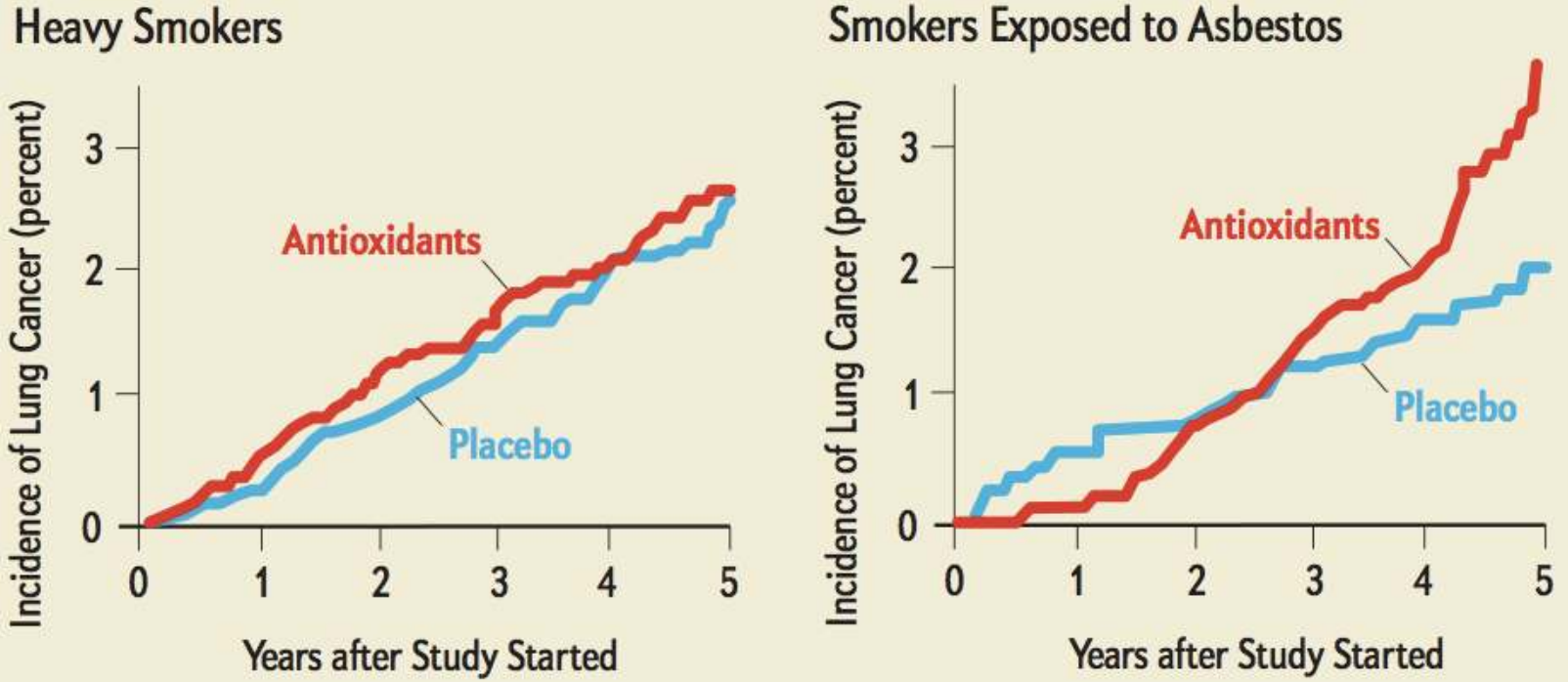
- Achieve the right balance and eat whole foods – limit supplements without expert evaluation.

Keep in mind that many foods that provide great benefits when consumed daily in smaller amounts can also be unsafe in large amounts. In other words, too much of a good thing can be a bad thing. Consider comparing a daily glass of wine to several glasses, food additives or even excess fiber can decreases the absorption of needed minerals. –excerpt from my article on the The Truth About Cinnamon

Antioxidant supplements?

Early Signs That Antioxidants Can Spell Trouble

A 1996 study of some 18,000 men and women found 28 percent more lung cancers and 17 percent more deaths in a group that was given beta-carotene and retinol compared with people who did not receive the antioxidants. The increased risk became clear after 18 months, particularly in heavy smokers, and was strongest among smokers who had been exposed to asbestos, a known carcinogen.



Antioxidant supplements?

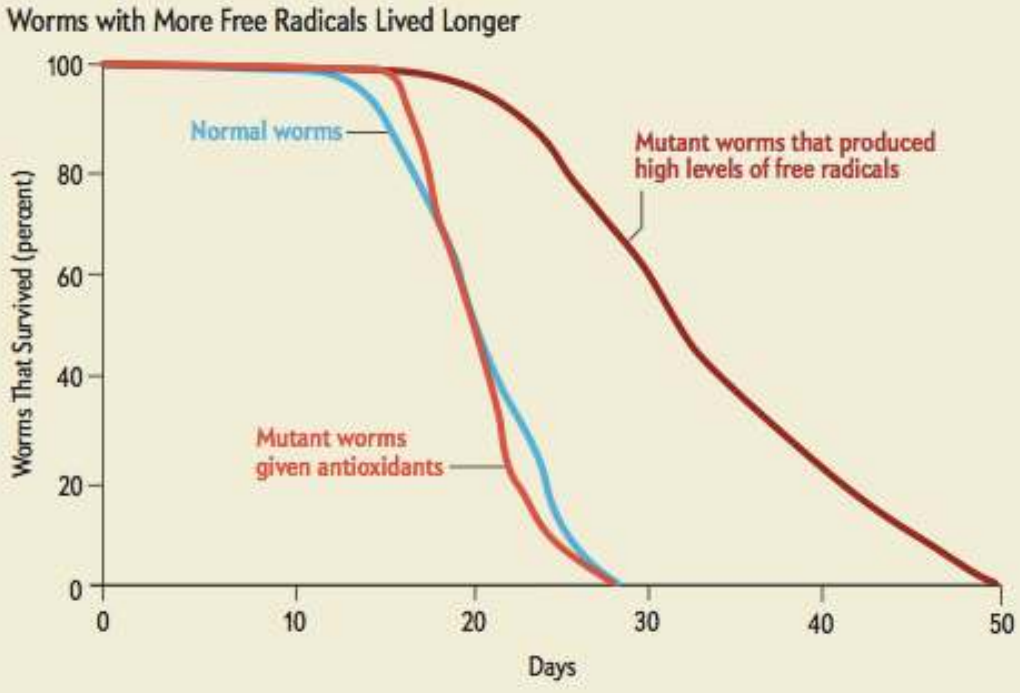
- 35,000 men take vitamin E (400 IU/day) selenium (200mcg/day) both, or a placebo for 5 ½ years. Vitamin E takers have a 17% higher risk of prostate cancer. Selenium has no effect. Be cautious with supplements. (JAMA, 306:1549, 2011)
- Recent experiments show that increases in certain free radicals in mice and worms correlate with longer life span.
  - In some circumstances, free radicals seem to signal cellular repair networks.

Moyer, M.W. 2013. The Myth of Antioxidants. Scientific American February 2013

Antioxidant supplements?

Insight from Mutant Worms

Rather than causing aging (through oxidative chemical reactions that trigger cellular damage), some free radicals may prove beneficial. One possibility, supported by the work of Siegfried Hekimi and Wen Yang, is that a certain number of free radicals stimulate an organism's internal repair mechanisms to get to work. In their experiment on roundworms, published in 2010, the researchers genetically modified a group of worms so that they produced high levels of certain free radicals. Much to their surprise, the mutant worms lived longer than the normal worms. When the investigators fed antioxidants to the mutant worms, their longevity advantage disappeared.



Moyer, M.W. 2013. The Myth of Antioxidants. Scientific American February 2013

Instead of supplements get cooking with healthy real foods:

- www.aicr.org noted before (has great recipes loaded with phytonutrients and a free reliable newsletter)
- If you have or work with kids, check out these tool kits and activities: www.superkidsnutrition.com/healthykids
- http://melissashealthyliving.com/category/recipes/
- Check out www.cspinet.org recipes
- http://www.nhlbi.nih.gov/health/index.htm#recipes
- Go to www.superkidsnutrition.com search whole food or meal ideas

How and Why Functional Foods Should Be Included in Your Diet

A summary of what we've learned!

When Choosing Functional Foods

- Pick whole foods rather than highly processed products such as fortified calorie or energy bars.
- If you're eating supplemented functional foods such as fortified bars or drinks, be cautious when taking additional supplements so you don't exceed tolerable upper limits for vitamins and minerals. The %RDA can be used as a guide.

When Choosing Functional Foods

- Continue to follow recommended dietary guidelines for conditions such as high cholesterol or hypertension, adding modified foods as directed by your Doctor and Registered Dietitian Nutritionist.
- Read labels carefully to find the source of added ingredients, such as fiber.
- To learn how to incorporate "super foods" into your children's or family's diet visit www.superkidsnutrition.com (search super foods) and www.choosemyplate.gov

Slide 69

16 This presentation didn't cover sources of fiber. I will look at other presentation to see if it is covered there.
Molly, 4/14/2014

Functional Foods

- Many foods have higher levels of certain phytochemicals and nutrients.
- For example, tomatoes and watermelon provide good sources of lycopene.
- See next 2 slides for examples.

Examples of foods with Higher Content of Specific Nutraceutical Substances

Nutraceutical Substance/Family	Foods of Remarkably High Content
Allyl sulfur compounds	Onions, garlic
Isoflavones (e.g. genestein, daidzein)	Soybeans and other legumes, apios
Quercetin	Onions, red grapes, citrus fruit, broccoli, Italian yellow squash
Capsaicinoids	Pepper fruit
EPA and DHA	Fish Oils
Lycopene	Tomatoes and tomato products
Isothiocyanates	Cruciferous vegetables
B-Glucan	Oat bran
CLA	Beef and dairy
Resveratrol	Grapes (skin), red wine
B-Carotene	Citrus fruit, carrots, squash, pumpkin
Carnosol	Rosemary
Catechins	Teas, berries

Examples of foods with Higher Content of Specific Nutraceutical Substances

Adenosine	Garlic, onion
Indoles	Cabbage, broccoli, cauliflower, kale, brussels sprouts
Curcumin	Tumeric
Ellagic acid	Grapes, strawberries, raspberries, walnuts
Anthocyanates	Red wine
3-n-Butyl phthalide	Celery
Cellulose	Most plants (component of cell wall)
Lutein, zeaxanthin	Kale, collards, spinach, corn, eggs, citrus
Psyllium	Psyllium husk
Monounsaturated fatty acids	Tree nuts, olive oil
Inulin, Fructooligosaccharides (FOS)	Whole grains, onions, garlic
Lactobacillii, Bifidobacteria	Yogurt and other dairy
Catechins	Tea, cocoa, apples, grapes
Lignans	Flax, rye

Summarizing Important Concepts

- It difficult to assess the bioavailability and effectiveness of photochemicals in the diet.
- Try to summarize key concepts into 3 concise sentences to help improve your understanding of these complex concepts.
- For example
  - How would you describe functional foods? *Foods which include everything from natural foods, such as fruits and vegetables endowed with antioxidants and fiber, to fortified and enriched foods.*

Summarizing Important Concepts

- How are functional foods regulated?
- What is oxidation?
- What is the Free Radical theory?
- Can you visualize how antioxidants work?
- What are some functional foods you include in your diet or have seen at the grocery store?

Thank You!!