CHAPTER 10: Nutrition for Disease

10. 1 Nutrient Needs for Disease Prevention & Management

Section Objectives

- Introduce the major chronic diseases and their etiological origins
- Explain how nutrient intake impacts disease risk as well as disease progression and regression
- Reinforce understanding of dietary components that can be modified to ameliorate disease

Learning Outcomes

- Identify key features of each of the discussed diseases
- Recall the metabolic abnormalities that underpin chronic disease onset
- Identify which nutrients are restricted and which are promoted in therapeutic diets
- Match nutrients to given healthy intake guidelines

Inappropriate food choices and unhealthy body weight **promote disease** by eliciting cell stress that could otherwise be avoided. Diet-induced cell stress stems primarily from an exacerbated level of oxygen radicals, or **reactive oxygen species**, that are commonly known as “free radicals.”

Free radicals cause microscopic lesions and other damage to cell membranes, DNA and cellular proteins. The injuries are healed by inflammatory responses that consume capillary stem and progenitor cells that are limited in their regenerative capacity. Over decades of added oxidative stress and low-grade inflammation, these stem and progenitor cells begin to heal less effectively, and then chronic degenerative diseases and mortality follow.

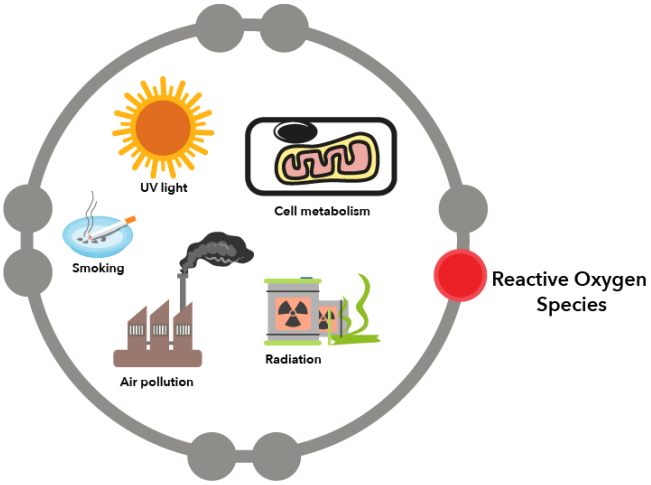


Figure 1. Sources of Cellular Reactive Oxygen Species (ROS)

Cardiovascular disease (CVD) is a culmination of dysfunctional factors in the endothelial tissues of the heart and circulatory system that may, over time, lead to a **myocardial infarction**, or **heart attack**. The process begins with an accumulation of fat in the inner surface of blood vessels that is oxidized by free-radicals. Over time, oxidative damage in the endothelium results in insufficient nitric oxide (NO) production and declining control of vascular tone and blood flow. Endothelial integrity is further compromised by vascular **inflammation**, consequ

ential cell adhesion, aggregation responses and the proliferation of vascular smooth muscle cells, which eventually leads to **atherosclerotic** lesions.

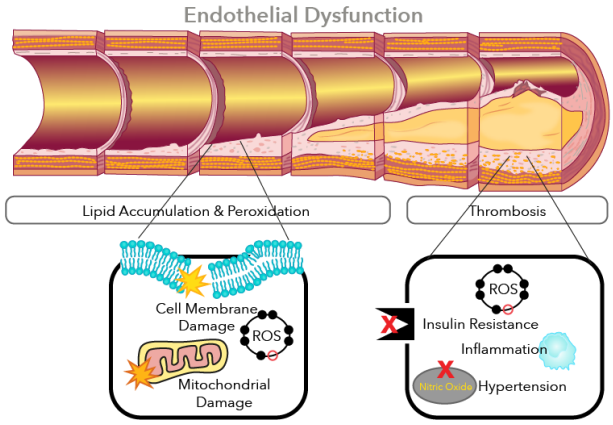


Figure 2. Pathogenesis of Atherosclerosis and underlying factors contributing to endothelial dysfunction.

Cancer is a disease that is characterized by uncontrolled cell division that leads to growth of abnormal tissues, or tumors. **Benign tumors** do not spread or invade tissues, and they are rarely a threat to life. **Malignant tumors**, however, can invade organs, spread to distant locations and can be life-threatening. The **DNA mutations** that initiate and promote the growth of cancer tumors are likely caused by genetic factors and exposure to environmental **carcinogens** that exacerbate cellular or tissue stress by oxidative stress and free radical activity. And while several possible cancer-causing carcinogens are consumed directly in low amounts in the regular daily diet, the progression and metastasis of cancers with etiological roots including **obesity, insulin resistance**, and **endothelial dysfunction** are more the focus of nutrition-related research regarding cancer.

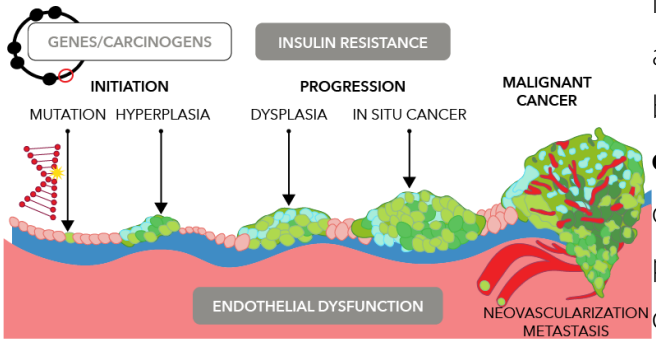
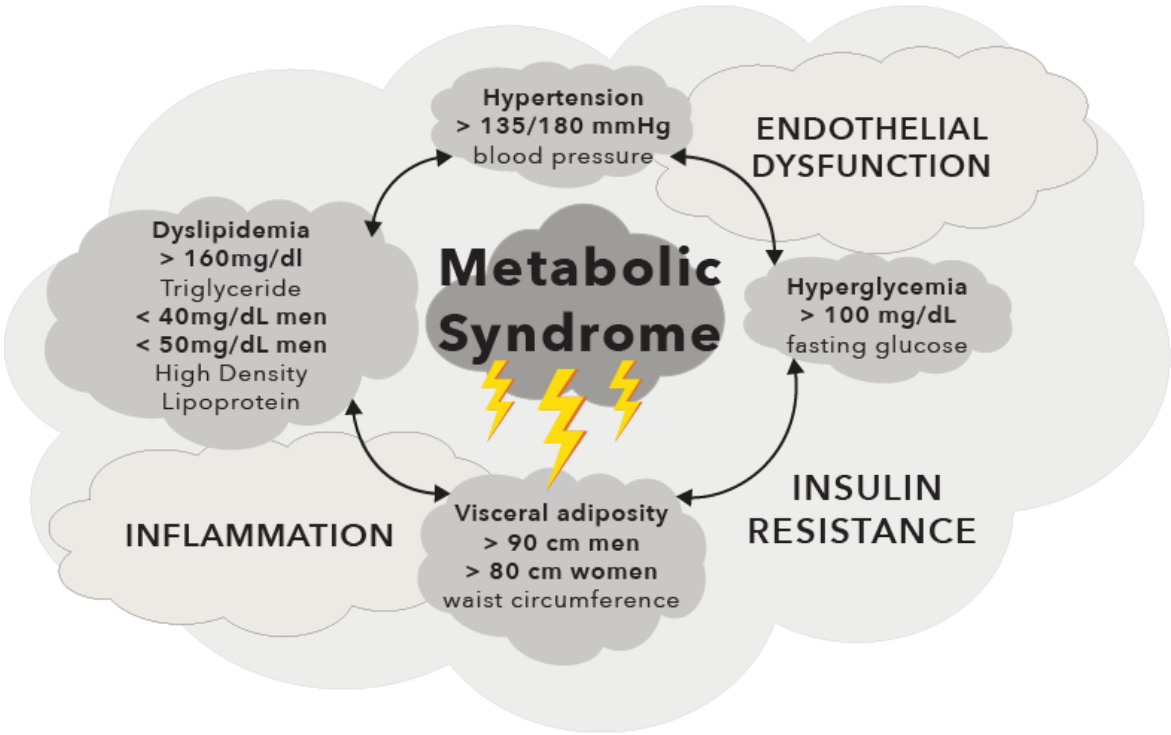


Figure 3. Stages of Cancer Onset and Progression. The progression and metastasis of cancer tumors is particularity influenced by insulin sensitivity and in-turn, endothelial dysfunction. Both of these metabolic perturbations can be brought on by, and are, exacerbated by dietary intake

Before chronic diseases are diagnosed or even symptomatic, there is series of intertwined physiologic manifestations that result in a clustering of metabolic abnormalities. Three or more "clustered" abnormalities is clinically referred to as the **metabolic syndrome (MetS)**, a condition that is related to a much greater risk for cardiovascular disease, adult-onset type II diabetes and several types of cancers. The underpinnings of the syndrome are centered on three central features: inflammation, insulin resistance and endothelial dysfunction.



Visceral adiposity exacerbates insulin resistance through a perpetuated immune response involving cytokines that interfere with insulin signaling. Insulin resistance, or insensitivity, causes the conditions hyperglycemia and hyperinsulinemia. Chronically higher postprandial blood glucose concentration and excessive insulin secretion may contribute to the loss of the insulin-secreting function by pancreatic β-cells and lead to irreversible **type 2 diabetes mellitus**, another prevalent metabolic diseases.

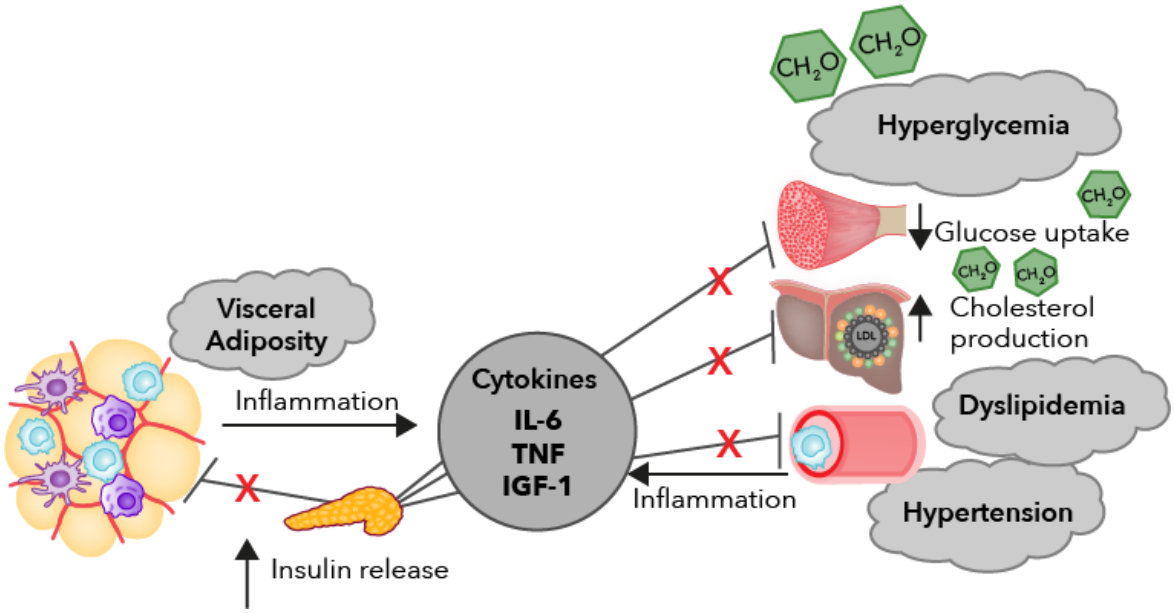


Figure 10.5 Dysfunctional adipose tissue causes inflammation (cytokine release) and in turn, insulin resistance. Persisting insulin resistance leads to hyperglycemia, dyslipidemia and hypertension, which perpetuates inflammation and dysfunction in the endothelium.

Dyslipidemia, a condition characterized by abnormal levels of serum cholesterol and lipoproteins, often follows insulin resistance as a result of increased hepatic cholesterol production from excess sugars and suppressed cholesterol clearance. Dyslipidemic and hyperglycemic conditions, together, in the endothelial

lining initiates the release of inflammatory cytokines that diminish endothelial relaxation, which leads to **hypertension.**

Disease Risk

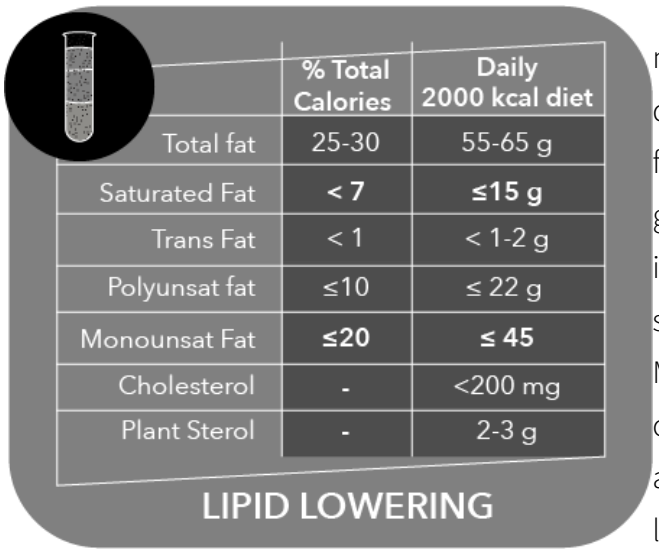
A person's **risk** for developing certain metabolic diseases is influenced by a variety of factors. Most of these factors are outside of our control, as they relate to the natural aging processes, sex hormones or familial factors involving race and ethnicity. Hereditary or in utero gene defects are also largely out of human control but, with advancing technology can be predicted with increasing accuracy. The manageable disease risk factors, known as "**lifestyle factors**" include inactivity, smoking, mental stress and poor diet. These factors can have a decisive impact in promoting the onset and progression of diseases and, when controlled, partially mitigate disease risk and re-occurrence.

Calories

					LIGHTLY ACTIVE	ACTIVE	VERY ACTIVE
♂ MEN	864 - (9.72 x age [y])	+ PA	(14.2 x weight [kg])	+ 503 x height [m]	1.11	1.25	1.48
♀ WOMEN	387 - (7.31 x age [y])	+ PA	(10.9 x weight [kg])	+ 660.7 x height [m]	1.12	1.27	1.45

FAT REDUCING

Excess calorie intake and ensuing excess body fat weight (i.e., obesity) is directly linked to higher risk of developing cancer, cardiovascular disease and type II diabetes. Coupling **calorie restrictions** from balanced amounts of essential nutrients with appropriate levels of physical activity usually elicits healthy weight loss, yielding a 500-1,000 calorie deficit each day. Nutrition for weight loss will be discussed in more detail in Chapter 11.



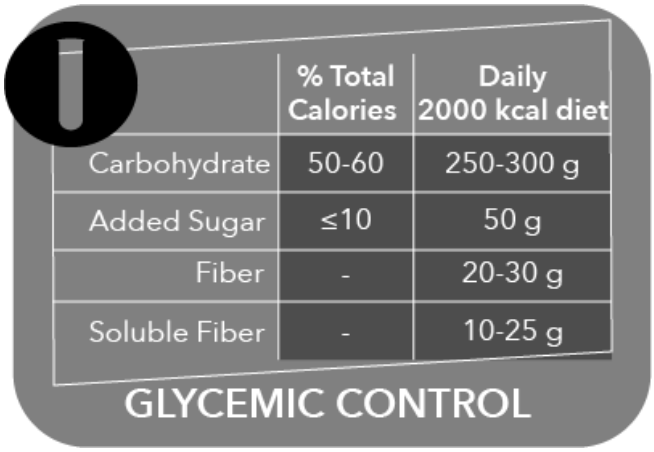
	% Total Calories	Daily 2000 kcal diet
Total fat	25-30	55-65 g
Saturated Fat	**< 7**	**≤15 g**
Trans Fat	< 1	< 1-2 g
Polyunsat fat	≤10	≤ 22 g
Monounsat Fat	**≤20**	**≤ 45**
Cholesterol	-	<200 mg
Plant Sterol	-	2-3 g

LIPID LOWERING

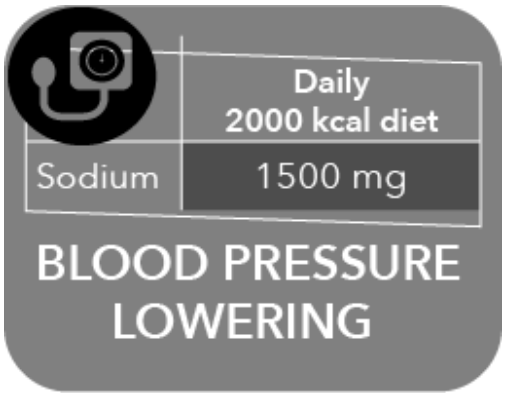
The unique **fatty acid profile** of the typical American diet may play an important role in the etiology of chronic diseases in the US. To improve that profile, the guidelines for recommended fats have been modeled after the guiding principles of the **Mediterranean diet**, with some inspiration from other long-living populations such as some groups of Eskimos and Japanese adults. Mediterranean diets permit consumption of 20-30%of total calories from fat, with most being of the monounsaturated and essential, polyunsaturated-type. This diet pattern is low in non-essential polyunsaturated fatty acids and is even lower in saturated fats. Since the American diet is high in saturated fats, the American Heart Association's National Cholesterol Education Program (NCEP) recommends limiting saturated fats substantially to 7% or less of total calories, and trans fats to less than 1%. For the small number of people who are "hyper-responders" to dietary cholesterol, exogenous cholesterol intake should be limited to less

than 200 mg/day. However, for the majority of healthy adults, daily cholesterol intake does not significantly affect blood cholesterol and should be restricted to the typical level of around 300 mg/day.

While the consumption of **carbohydrates** in the form of corn syrup in the typical American has grown, and the intake of dietary fiber has declined, the prevalence of type 2 diabetes has escalated. Carbohydrate intake for disease therapy and prevention should aim to provide roughly 50-60% of calories from mainly complex carbohydrates, and restricted to less than **10% from added sugars**. Although current US dietary guidelines do not use glycemic index (GI) nor glycemic load (GL) measurements, diets with lower GI or GL levels that are **higher in dietary fiber** from whole plant foods, rich in viscous fiber are recommended for diabetes prevention and treatment. For individuals diagnosed with diabetes, 25-50 g fiber/day with a good portion from viscous fiber sources is beneficial for reducing disease-associated risks.

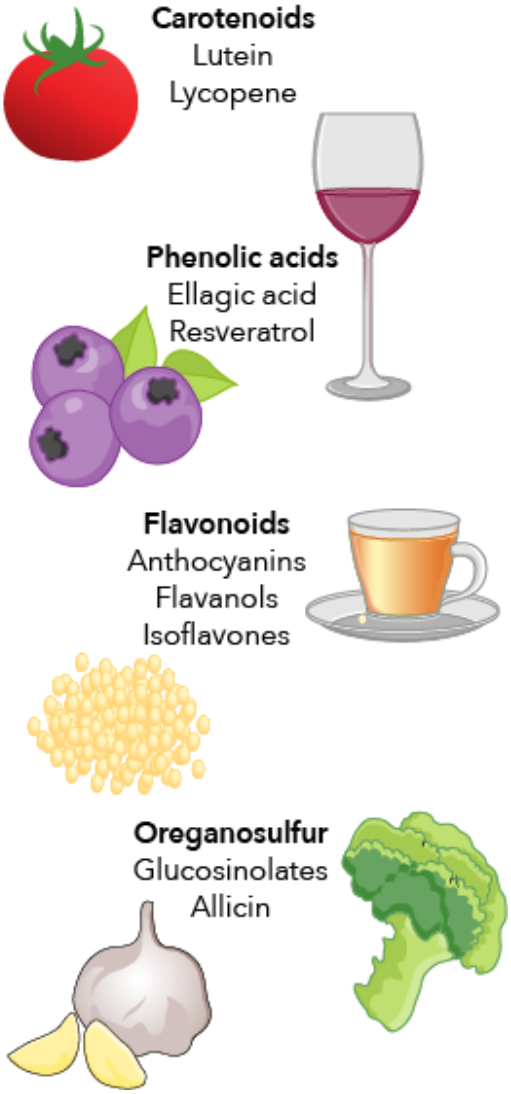


Sodium-rich diets can lead to hypertension in healthy people, in people who are "salt sensitive," or in those who already exhibit pre-hypertensive symptoms. A low sodium diet has been an effective way to reduce blood pressure. The Dietary Approaches to Stop Hypertension (DASH) diet recommends daily consumption of no more than **1500 mg of sodium chloride** (i.e., salt) together with a concomitant increase in potassium-rich food intake.



Since cell stress is exacerbated in the presence of free radicals, and exogenous antioxidants from the diet mitigate cell damage associated with atherosclerosis and cancer development, **antioxidant intake** is an important dietary consideration for those concerned with disease prevention. While there are many unsubstantiated claims about the benefits of antioxidant nutrients, there is reliable scientific evidence for some vitamins including beta carotene, vitamin C and tocopherol that may, indeed, have protective benefits.

A number of **phytochemical compounds** may additionally contribute to the disease protective-effects of plant foods. And while phytochemicals are not established essential nutrients, they have been evaluated in nutrition research for their ability to reduce oxidative damage, pro-inflammatory gene transcription and cholesterol absorption. And although supplementation of individual micronutrients or phytochemicals from superfoods has not generally resulted in significantly decreased incidence of disease morbidities, the potential of whole foods rich in these compounds cannot be overlooked.



Patients who are actively treating cancer may have slightly different dietary needs to overcome cancer and its treatments. Appetite loss commonly occurs in cancer patients as a result of the physiological fatigue or pain, or because of feelings of fear, depression and anxiety that can result from the diagnosis. **Cancer treatments** including chemotherapy, radiation therapy and immunotherapy are known to cause side effects that lead to eating difficulties and changes in nutritional status. Treatment side effects may even adversely change taste or smell perceptions to less intense, bitter or even metallic.

10.1 Homework 1
Review

Free radical damage is most evident in which TWO cell structures?

Targets placed: 1/1

Undo Delete selected Remove All

You can place up to 1 targets

Explanation

Yes, the membranes - of cells and mitochondria

Show Submitted Answer Show Correct Answer Check My Answer

10.1 Homework 2
Review

The Metabolic Syndrome is a disease characterized by abnormally high blood __.

- A sugar
- B lipids
- C pressure
- D all of the above

Explanation

Yes, the syndrome is characterized by a quartet of metabolic symptoms that includes high blood sugar, high blood pressure and high blood lipid

Show Submitted Answer | Show Correct Answer | Check My Answer

10.1 Homework 3
Review

The underlying factors that link metabolic syndrome abnormalities to chronic diseases includes:

- ○ **A** Inflammation
- ○ **B** Insulin resistance
- ○ **C** Endothelial dysfunction
- ◉ **D** all of the above

Explanation

Yes, all of the above contribute to Metabolic Syndrome - Chicken or the Egg on which of these is most exacerbating in the pathogenesis of chronic diseases.

Show Submitted Answer | Show Correct Answer | Check My Answer

Comprehension Check: 1 Homework Point
Review

Which of the following disease risk factors is not associated with life style?

- A Smoking
- B Diet
- C Inactivity
- D Stress
- E Genetics

Explanation

Yes, genes are cells codes, which are programmed at birth - thus genetics are not influenced by lifestyle - However, new theories about in utero nutrition may challenge this notion

Show Submitted Answer | Show Correct Answer | Check My Answer

10.1 Homework 4
Review

The guidelines for fat intake for disease prevention are largely modeled after what healthy population's dietary pattern?

- A French
- B Chinese
- C African
- D Mediterranean

Explanation

The Mediterranean Diet has a nutrient profile (mainly fat) that agrees with heart-health and cancer-prevention promotions.

Show Submitted Answer | Show Correct Answer | Check My Answer

10.2 Nutrient Sources for Disease Prevention and Regression

Section Objectives

- Expand understanding of each major food group and meal balance
- Provide healthy, disease preventative meal preparation guidelines
- Highlight potentially dangerous components hidden in convenience and fast foods

Learning Outcomes

- Discuss the major dietary factors in each food group that contribute to disease onset and progression
- Recognize the major dietary factors in each food group that mitigate disease risk
- Match a phytochemical compound to a food or food pigment (color)

The **diet pattern** for diseased or at-risk populations is centered on the restriction of foods that may promulgate disease onset or progression and, concomitantly, the promotion of foods that may have disease-preventative compounds. As **meal and diet** planning using

nutrient levels can be difficult, programs and designations for food products that meet "**healthy**" criteria, can be used instead. Food products are also allowed to claim on the package if their product is "lower" in fat or salt, than a competitor, or is "reduced" compared to the fat and salt content of a previous edition. This method relies on one's understanding of food labels, symbols and claims to help guide meal and snack choices.

Animal meat is a high-quality source of dietary protein and minerals. Lean and extra lean cuts of poultry, fish or pork should be consumed 1-3 times daily in an amount around the size of a deck of cards. At least two servings each week should come from AHA-designated "heart healthy" fish–that is, fish containing less than 16 grams of fat, less than 4 grams of saturated fat and at least 500 mg of omega-3 fatty acids per 3 oz. cooked serving. Fatty cold-water fish like salmon, mackerel, tuna, herring and sardines contain high amounts of omega-3s. Fish like bass, tilapia, cod and shellfish contain lower levels of omega-3s but are generally leaner than fatty cold-water fish. Farmed fish usually have higher levels of EPA and DHA than wild-caught fish, but those levels vary depending on the composition of the fish's diet. This is true for other animal species, as well. For instance, beef is traditionally very low in omega-3s, but beef from grass-fed cows contains higher levels of ALA than meat from grain-fed cows because of diet alone.

To reduce fat intake from animal meats, it is important to trim **separable fat** from meat before cooking and to render out **marbleized fat** during cooking using drip pans or tilt skillets. Meats should be prepared using broiled, baked, poached or roasted cooking techniques, and chargrilled, heme-iron rich red meat should rarely be consumed. **Sodium-preserved, prepared meats** such as bacon, sausage, hot dogs and lunch meats, and fatty cuts of animal meats like ribeye steak, duck, goose or organ meats (e.g., liver) should also be limited. When dining out, entrees featuring meats described as "fried," "crispy," "creamy" or "stuffed" should usually be avoided, as well.

Oils provide essential fats and fat-soluble vitamins in the diet. Olive, rapeseed, marine and mustard seed oils are the richest sources of **monounsaturated fats**. Polyunsaturated omega 3 and omega 6 fatty acids are prevalent in, among others, flaxseed, pumpkin seed, canola, soybean (not hydrogenated), walnut, safflower, sunflower and sesame oils. Liquid oils that are high in monounsaturated fats should be used in cooking and baking as much as possible in place of saturated coconut, palm, and palm kernel oils, butter, and solid vegetable oils, like Crisco. Oils should be purchased in opaque bottles to preserve light-sensitive nutrients, such as vitamin E. Monounsaturated fatty acid-rich peanut and extra virgin olive oils stand up well to cooking, which is important to prevent carcinogenic changes to fatty acids that occur when vegetable oils are heated to very high temperatures.

Hydrogenated and partially-hydrogenated oils that are made into margarines, shortenings or into texturizing or preserving ingredients are often hidden in processed foods. **Convenience foods** such as frozen pizzas, biscuits, microwave popcorn, peanut butter and some breakfast cereals, for example, that contain the word "hydrogenated" anywhere in the ingredients list should be avoided entirely.

Milk and yogurt are good sources of essential nutrients and can also be used to replace butter and oil in recipes. The AHA recommends that dairy foods provide 130 calories or less per 8 fl oz., and that a 6 oz serving of yogurt have 20 grams or less of total sugar per serving. With the recent boom in smoothies in the health food market, the AHA added a new guideline that **smoothies** should provide 200 calories or less per 8 oz. serving, or 300 calories for 12 oz. There should be 2 teaspoons (8 g) or less of added sugar per smoothie serving, and at least one whole serving of dairy or dairy alternatives (e.g., nut/grain/soy-based milks; not ice cream) or a whole fruit or vegetable serving (not juice concentrate).

Whole-grain cereals, breads, pastas and snack bars are made from whole grain seed flours, are typically high in fiber, and usually have a low GI. Superior grain products are labeled "100% whole grain" or "100% whole wheat." With the growing popularity of meal replacement and **snack bars**, the AHA has added a new requirement that recommended grain-based snack bars be a "good source" of dietary fiber (i.e., providing 10% or more of Daily Values) and contain 7g or less of total sugars per serving. If the bar is a "good source" of dietary fiber (20% or more of Daily Values), the allowance for sugar is 2 grams higher. Grain-based snacks and desserts, like doughnuts and cakes, tend to include a great deal of added fat to enhance mouth feel and texture and, for that reason, should be consumed sparingly. Baked grain products should be avoided in the daily diet as well because they are often very high in either sugar or salt.

Seeds that are rich in swellable fiber can be effective to replace fats in baked grain pastries. For example, chia seeds and flax seeds can effectively replace eggs in many pastry recipes. They provide moisture and binding properties that enhance the texture of products like muffins and cookies. **Leguminous seeds and beans** are also high in viscous fiber, have relatively low glycemic effects and, in addition, provide magnesium and phytosterols in the diet. The beans and legumes highest in fiber include peas, lentils, and pinto, black, red and kidney beans which can provide up to 10 grams of fiber per serving. Bean soups varieties are excellent sources of fiber but, like all soups, contain significant levels of sodium. The "**low sodium**" designation for soups, like other food products, requires at least 25% less sodium than a suitable reference food with "regular" sodium levels, which can still be considerable. Effective ways to reduce sodium in soups made from scratch include using potassium chloride salt substitutes and larger quantities of other traditional soup spices like basil, thyme or oregano. Diversifying the spice profile of foods other than soups with more dominant, forward spices such as cumin, pepper or paprika may also help sensory acceptance as these flavors can help compensate for missing salt.

Soybeans and soybean-derived products including soy milk, soy flour, soy protein isolate and soy isoflavones are particularly high in **plant sterols**. Isolated soy isoflavones taken in dietary supplements and fortified food products is usually supplied in doses that range from 50 to 99 mg/day because the amount consumed in the typical American diet (.2g) is insufficient to elicit a meaningful physiological impact. In 1999, the FDA approved the following health claim: "Diets low in saturated fat and cholesterol that include 25 grams of soy protein a day may reduce the risk of heart disease," which is around 1.6 to 3.0 grams of phytosterols per day.

Nuts are also good sources of soluble fiber and phytosterols. The nuts richest in phytosterols are pistachios, cashews and peanuts, which although technically legumes, are marketed and packed as nuts. Peanut butter, however, has half the phytosterols that peanuts have highlighting the significance of processing effects on food content. The FDA has acknowledged the emerging evidence of a relationship between nut consumption and lower cardiovascular disease risk by approving the following qualified health claim for nuts: "Scientific evidence suggests but does not prove that eating 1.5 ounces per day of most nuts as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease." Raw nut varieties (i.e., not oil roasted) that are "unsalted" or "lightly salted," meaning they have 50% less salt than "salted" varieties, still contain over 140 mg of sodium per one ounce serving. As such, the consumption of nuts, like soups, should be carefully monitored in the diet.

Fruits and vegetables are among the most nutrient dense foods in the diet. They are a rich source of fiber, minerals, anti-oxidant vitamins and phytochemicals. The purpose of the National Cancer Institute's program, "fruits & veggies - more matters®," is to increase fruit and vegetable consumption in the US to a minimum of **five servings daily**. Fruits and vegetables are the main sources of fiber in the US diet. The fruits and vegetables that are highest in fiber are apples and berries (e.g., blueberries, blackberries and strawberries); dried fruits like prunes, apricots, dates, and raisins; and vegetables such as broccoli, Brussels sprouts, cabbage, green leafy vegetables (e.g., spinach, lettuce, kale and collard greens) and potatoes with skins.

The **antioxidant** capacity of plant foods and compounds is quantified by the oxygen radical absorbance capacity unit, or "ORAC score." To maximize the antioxidant power, or ORAC potential of fruits and vegetables, items from the entire color spectrum should be included in the daily diet. Of the top 20 most antioxidant-rich fruits and vegetables, 7 are red. The "**red group**" foods are a great source of carotenoids (i.e., provitamin A), anthocyanins, betacyanins and lycopenes. The "orange-yellow group" includes vegetables such as carrots, sweet potatoes, yellow potatoes, pumpkins, squash and yellow peppers, and fruits like oranges, tangerines, grapefruit, mangoes, cantaloupe, apricots and bananas. The "blue-purple group" foods are great sources of anthocyanins and **resveratrol**, which is found in the skin of grapes consumed in purple grape juice and red wine. The "white group" foods such as garlic and onions, offer significant amounts of allicin, indoles and allyl sulfides. The "green group" foods are an important source of lutein and zeaxanthin which are technically yellow-orange pigments that are masked by the chlorophyll in green foods.

Certain species of the "dark green" group, the **cruciferous vegetables**, are part of the Brassica plant family. They include cabbage, kale, broccoli, Brussels sprouts, mustard greens and despite the pale pigment, cauliflower. These vegetables contain glucosinolates, which are sulfur-containing chemicals responsible for the pungent aroma and bitter flavor of cruciferous vegetables. During food preparation, chewing and digestion, the glucosinolates are broken down to form the biologically active compounds indoles, thiocyanates and isothiocyanates. One large dark green salad that includes shredded cabbage or kale with broccoli and other salad accoutrements would be an excellent

lunch-time meal to ensure maximal isothiocyanate intake. However, even nutritious salads can be rendered “unhealthy” if they are smothered in highly polyunsaturated dressings and salad creams, so adopting a daily salad routine with appropriate amounts (i.e., one tablespoon) of the right types of oils (preferably, olive oil) is critical to exploiting the value of cruciferous vegetables.

Garlic is a vegetable that belongs to the Allium class of bulb-shaped plants, which includes onions, chives, leeks and scallions. Garlic is used for flavoring in cooking and is unique because of its high sulfur content. The distinctive odor and flavor of garlic comes from sulfur compounds formed from allicin—the major precursor of garlic’s bioactive compounds that are formed when garlic bulbs are chopped, crushed or damaged with chewing. **Garlic supplements** can be classified as essential oils, garlic oil macerate, garlic powder and garlic extract.

Phytochemicals
Review

Review: "Top 6" phytochemicals listed in the table at
https://www.fruitsandveggiesmorematters.org/what-are-phytochemicals
Match the facts (on the left) to the correct phytochemical (on the right)

Premise	Response	Drag and drop to match
1 purple pigment		→
2 orange pigment		→
3 concentrated in red wine		→

Show Submitted Answer | Show Correct Answer | Check My Answer

Tea is composed of **polyphenols**, alkaloids (i.e., caffeine, theophylline and theobromine), amino acids, carbohydrates, proteins, chlorophyll and volatile organic compounds which combine to create vapors that create the characteristic odors of teas. The polyphenols in tea are comprised of various plant chemicals including the **catechins**, of which, the most the most active and abundant chemical is epigallocatechin-3-gallate (EGCG). The polyphenol concentration of a certain tea

beverage depends on the type of tea, with green and white tea being much higher than black; the amount used; the brew time; and the brew temperature. The highest polyphenol concentration is found in brewed hot tea, with less in instant preparations, iced and ready-to-drink teas. As the percentage of tea solids (i.e., dried tea leaves and buds) decreases, so too does polyphenol content. Decaffeination also reduces the catechin content of teas.

Meal Patterns for Cancer

Cancer patients who suffer a loss of appetite or experience difficulty eating should aim to have 5 or 6 small meals each day, instead of 3 large meals. Healthy foods that require little or no cooking, such as frozen dinners, or ready-to-eat foods, like sandwiches, salads and washed and cut raw fruits and vegetables available for convenient consumption. Healthy home-prepared meals that are cooked ahead of time and frozen in meal-sized portions are ideal, but liquid or powdered meal replacements, like “instant breakfast” drinks, can also add much needed calories, vitamins and minerals in a small 8-12 ounce serving. Easy-to-carry snacks including peanut butter crackers, nuts, granola bars and dried fruits can also be helpful in adding calories, as needed.

Therapeutic diets that are **low in fiber** should include plain or vanilla yogurt, white toast and white rice. Meats like eggs, fish and poultry (skinless and baked, broiled or grilled) are also low in fiber, as are cooked and refined cereals (e.g., Cream of Rice®, instant oatmeal and grits), potatoes without skins (boiled or baked), white bread and white rice. Low-fiber treats include angel food cake, animal crackers, custard, gelatin, ginger snaps, graham crackers, saltine or soda crackers, sherbet, sorbet, and vanilla wafers.

Foods that accommodate **changes in taste acuity** may be needed to maintain a healthy daily diet in those with cancer. The essence of meats, especially chicken and fish, can be changed by soaking them in marinades, fruit juices, wine or even salad dressings. Extra flavor can also be added with a variety of strong flavored foods. For instance, adding a small amount of bacon, garlic or onions, or chopped basil, oregano or rosemary to vegetables and meats can enhance their taste and aroma profiles. Adding tart spreads such as orange marmalade or lemon custard may taste good to patients with impaired taste sensitivity but should be consumed cautiously by those with sore mouths or throats.

Foods for dry mouth should be sweet and tart, like lemonade, to trigger the salivary glands. Chewing gum, hard candy, popsicles, and ice chips can help dry mouth during non-meal periods. Meals should be easy to swallow like soft soups and cooked and pureed fruits and vegetables. Foods can be moistened to ease swallowing with sauce, gravy or salad dressing. Beer, wine or any type of alcohol beverage exacerbates dry mouth and, thus, should be avoided, as should foods that are very dry, hard or crunchy. Eating with nausea, diarrhea and vomiting should emphasize clear liquids (such as water or bouillon) and electrolytes.

Some cancer treatments can increase susceptibility to infection. To avoid infection, hot foods should be kept hot, and cold foods must be kept cold. Raw fruits and vegetables including those with rough exteriors, like melons, should be scrubbed completely before consumption. Foods that are difficult to wash thoroughly, like raspberries, should be avoided entirely. Hands, knives and counter tops should be washed before and after handling foods, especially raw animal meats. Raw chicken, turkey and fish should be thawed in the refrigerator or defrosted in the microwave, and all meats and eggs should be cooked thoroughly before serving. To reduce the chances of hand-to-hand food contamination, cancer patients are encouraged to steer clear of foods from bulk bins, buffets, salad bars and self-service restaurants.

10.2 Homework 1
Review

Which two foods are highest in phytosterols?

- (●) **A** soy and nuts
- ( ) **B** wheat and corn
- ( ) **C** fruits and vegetables
- ( ) **D** red meat and dairy

Explanation

Nuts are approved to claim "phytosterols" are good for heart health -- and isolated soy sterol compounds are used as adjunctive to statin therapy

Show Submitted Answer | Show Correct Answer | Check My Answer

10.2 Homework 2

Review

Match each phytochemical to it's originating food or plant group

Premise	Response	Drag and drop to match
1 garlic		→
2 the blue-purple group		→
3 green tea		→
4 soybeans		→
5 cruciferous vegetables		→

Show Submitted Answer | Show Correct Answer | Check My Answer

10.2 Homework 3
Review

Touch the DASH guideline for daily sodium intake.

Targets placed: 1/1

Undo Delete selected Remove All

You can place up to 1 targets

Explanation

Yes!

Show Submitted Answer Show Correct Answer Check My Answer

10.3 Nutrient Processing with Disease & in Disease Prevention & Regression

Learning Outcomes

- Identify dysfunctional processing intermediates and outcomes in the GI tract, epithelium and hepatic tissues
- Match dietary factors to dysfunctional tissues or mechanisms whereby it contributes to dysfunction

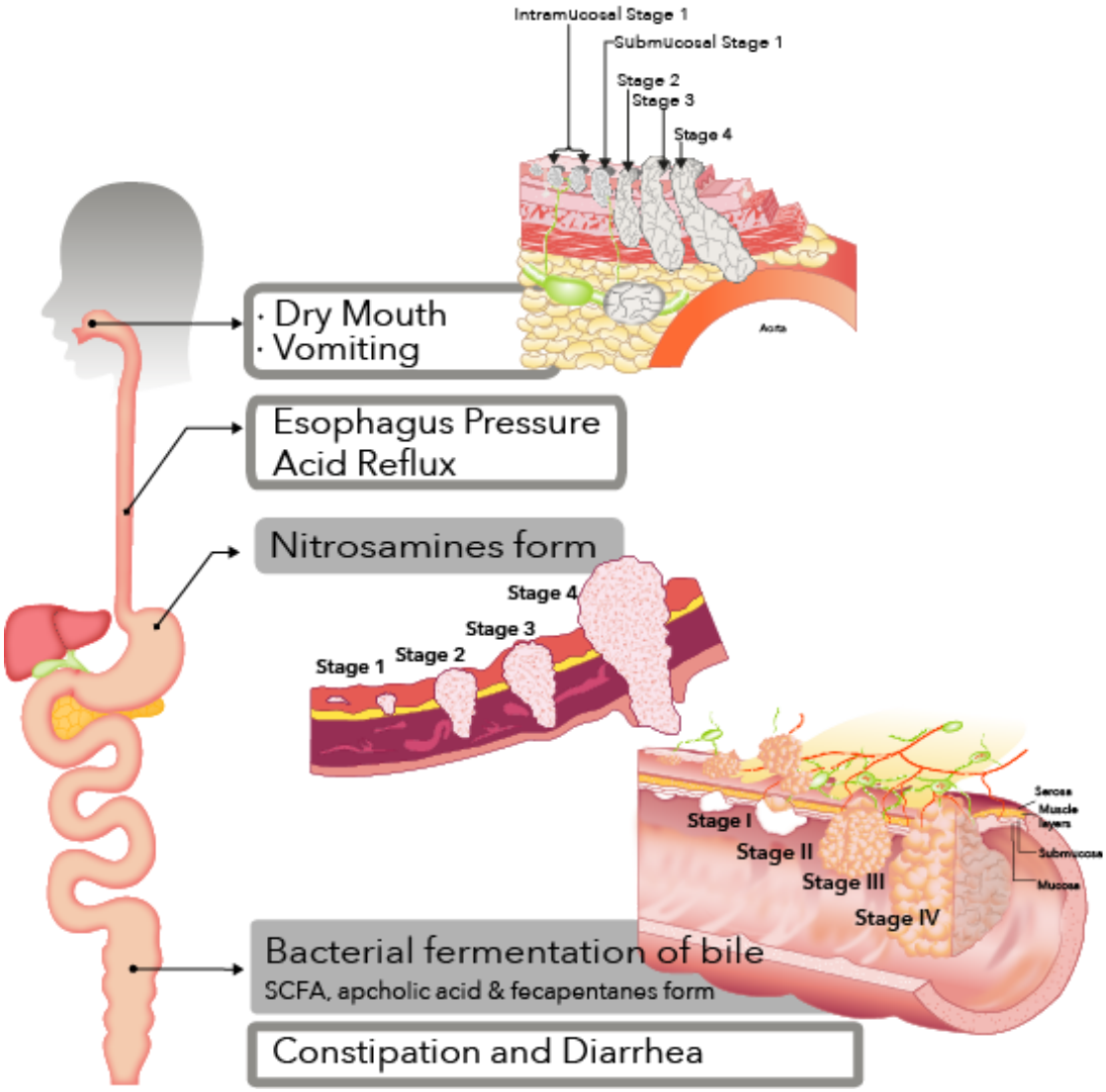
Nutrient processing systems are negatively affected by several dietary factors that promote disease onset. These systems are also impacted adversely by certain diseases and their treatments. Of the major systems in the human body that exhibit dysfunction stemming from chronic disease, the gastrointestinal tract, endothelial lining, and the hepatic (i.e. liver) are most influenced by diet and nutrition.

Gastrointestinal Dysfunction and Disease

During chemotherapy and radiation therapy to the head or neck area, the glands that make saliva can be damaged so that patients may have **dry mouth** and trouble swallowing. Chemotherapy can also cause constipation, which is characterized by frequent and hard, dry stools that are difficult to pass with accompanying symptoms including belching, gas, stomach cramps or pressure in the rectum. Mild to severe **diarrhea** can also occur as a result of cancer treatments, especially with therapy to the abdomen or pelvis area, as damaged cells in the lining of the large and small bowels lose their ability to slow the passing of foods and liquids which ensures adequate absorption of nutrients and water. Additionally, biological therapy and some types of chemotherapy and radiotherapy to the abdomen, small intestine or colon can cause **nausea, vomiting**, or both. Vomiting can occur immediately post-treatment, or as late as 1-2 days thereafter, and is usually preceded by nausea or upset stomach, and is often triggered by food odors.

Alcohol can act as an irritant in the cancer patient's diet, especially in the cells of the upper gastrointestinal tract. Additionally, bacteria that normally live in the colon and rectum can convert alcohol into large amounts of acetaldehyde, a chemical that is potentially carcinogenic. Alcohol may also contribute to a carcinogenic GI environment by enabling other harmful chemicals, like those found in cigarettes, to enter the cell lining of the upper digestive tract more easily.

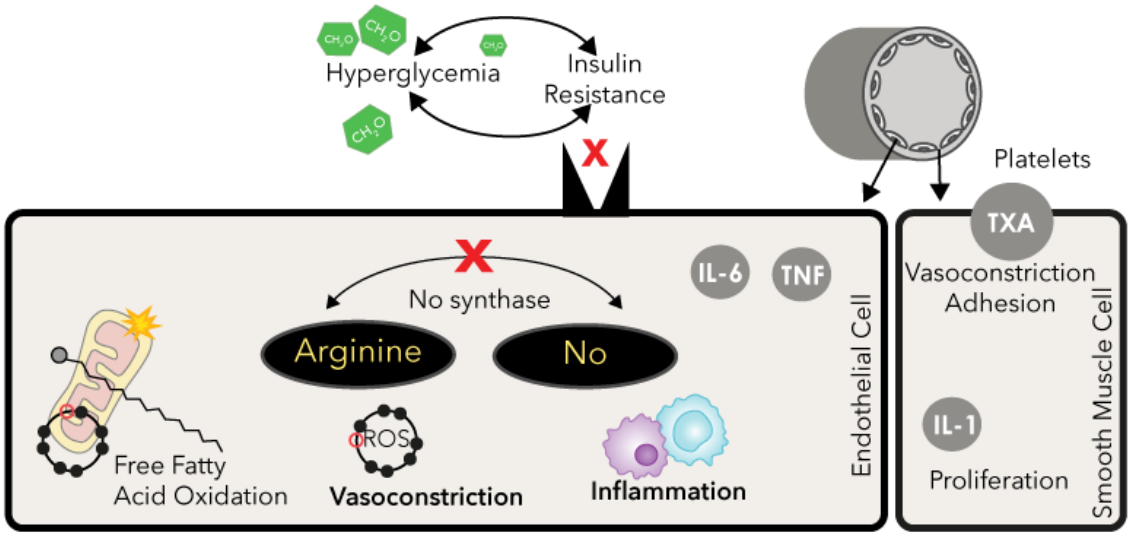
High fat meals elicit larger volumes of bile secretion into the small intestine. Excess bile and high fat decaying food matter in the colon can promulgate bacterial fermentation and carcinogen production. Carcinogenic compounds that may mutate colon cell DNA include apcholic acid, more than twenty types of fecapentanes and short-chain fatty acid compounds. Heterocyclic amines or **N-nitroso compounds** are generated when heme-iron and fatty acids in meat are cooked at high temperatures, and also in the gastrointestinal tract following consumption of red and processed meat.



Summary of 1. GI symptoms and conditions related to cancer treatment (outlined text box) and 2. Dietary influences on stomach and colon cancer.

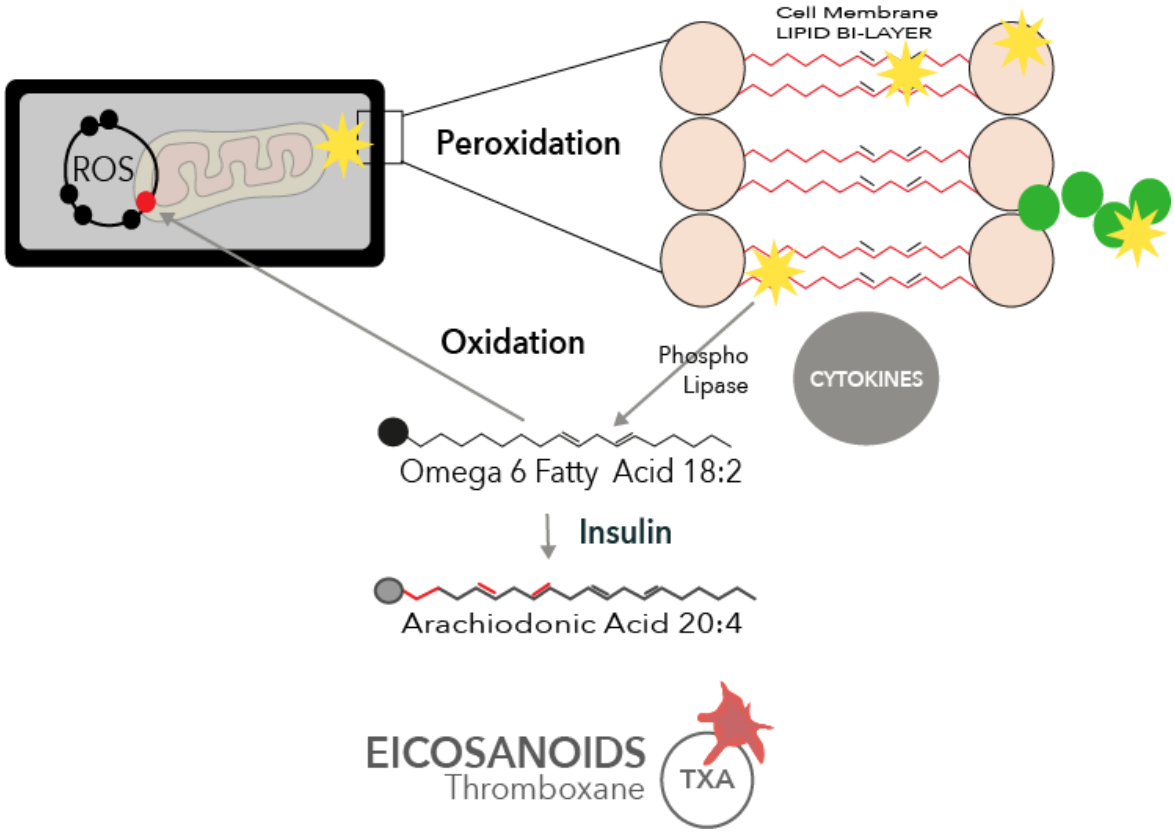
Endothelial Dysfunction and Disease

A prominent feature of **endothelial dysfunction** is diminished vascular enzyme nitric oxide synthase, or eNOS, activity. “Uncoupled” eNOS leads to superoxide radical formation, which rapidly reacts with nitric oxide to form peroxynitrite anion. This reaction initiates a **pro-inflammatory response** in the endothelium, which impairs Akt kinase phosphorylation. The combined effects of inadequate dilation of blood vessels to dispose of glucose and reduced glucose uptake due to failed Akt kinase activation and translocation of GLUT-4 in the muscle, produce **hyperglycemia**.



Following a **high salt meal**, or with chronic high salt intake, plasma sodium levels increase from the normal values to 135-150 mmol/L. Increased plasma sodium, coupled with limited dilation capacity caused by endothelial dysfunction in the small vessels of the kidney, causes increased fluid retention. This additional fluid causes pressure and stiffness within the endothelium and between the smooth muscle layer leading to high blood pressure. High blood pressure leads to pre-hypertension (120/80 mm/Hg) and, eventually if untreated, hypertension (140/90 mmHg). Hypertension is a clinical condition that promotes inflammatory responsiveness and enhances LDL and platelet aggregation and plaque formation.

Chronic excess intake of **saturated and polyunsaturated fats** contributes to endothelial dysfunction. Endothelial cell membranes are composed of glycolipids and phospholipids that feature 16-20 carbon chains with, or without, double bonds. The length and degree of unsaturation of these carbon chains have a profound effect on membrane fluidity as unsaturated lipids create a kink, preventing the fatty acids from packing together as tightly, thereby increasing membrane fluidity. A lipid bi-layer with many double bonds though, is more susceptible to free radical oxidation and ensuing inflammation.



Excessive and prolonged intake of polyunsaturated fats in combination with high glycemic foods exacerbates endothelial dysfunction. Endothelial cell membranes serve as a pool of polyunsaturated fatty acids that can be converted to various bioactive lipids for metabolism. Insulin and other cell signalers initiate enzymes to cleave fatty acids from the sn-2 position of membrane phospholipids. Liberated fatty acids serve as substrates for the production of bioactive lipid mediators, DGLA, di-homo-y-linolenic acid, arachidonic acid (AA) and eicosapentaenoic acid (EPA). **Insulin** catalyzes desaturase enzymes to direct linoleic acid through the pathway to the pro-inflammatory eicosanoid AA, instead of the anti-inflammatory eicosanoid, EPA. AA triggers the release of inflammatory cytokines that cause platelet aggregation, which initiates clotting and vasoconstriction of the endothelial smooth muscle. **Platelet aggregation** is a harmful first step in the formation of blood clots that can occlude arteries and lead to myocardial infarction, or ischemic stroke.

Hepatic Dysfunction and Disease

Dyslipidemia, or high blood cholesterol, is the result of
increased hepatic cholesterol and fatty acid production from **excess sugars** and a suppression of lipoprotein lipase, the major mediator of cholesterol clearance. Very low-density lipoprotein (VLDL) is metabolized into remnant lipoproteins (apoB) and small dense low-density lipoprotein (LDL), which both promote atherosclerotic plaque formation. Additionally, the triglycerides in VLDL are transferred to high density lipoprotein (HDL) by cholesterol ester transport protein, which makes HDL a more suitable substrate for hepatic lipase action and clearance when it passes through the liver. This exacerbates the levels of small dense LDL particles because fewer HDL particles are available to participate in reverse cholesterol transport from the vasculature.

10.3 Homework 1
Review

Which of the following dietary factors has not been studied as a potential gastrointestinal carcinogen?

- ○ **A** Red meat
- ○ **B** Nitrate-containing preservatives
- ○ **C** Alchohol
- ◉ **D** Viscous fiber

Show Submitted Answer | Show Correct Answer | Check My Answer

10.3 Homework 2
Review

Which of the following dietary factors plays the most direct role in increasing pressure in the blood vessels?

- ○ **A** Fat
- ◉ **B** Salt
- ○ **C** Sugar
- ○ **D** Cholesterol
- ○ **E** Alchohol

Explanation

Yes, Salt (or sodium) intake influences blood pressure in some people

Show Submitted Answer | Show Correct Answer | Check My Answer

10.3 Homework 3
Review

How are high glycemic foods connected to inflammation ?

- ○ **A** Insulin inhibits pro-inflammatory pathways
- ○ **B** Alpha linolenic (omega 3) promotes pro-inflammatory pathways
- ◉ **C** Insulin promotes pro-inflammatory pathways
- ○ **D** None of the above

Explanation

Yes, Insulin promotes conversion to inflammatory (AA) pathways

Show Submitted Answer | Show Correct Answer | Check My Answer

10.3 Homework 4
Review

Excess sugars contribute to dyslipidemia by increasing which of the following ?

- A Insulin secretion
- B Bile acid secretion
- C Hepatic cholesterol production
- D Blood pressure

Explanation

Yes. Excess sugars are converted to acetyl compounds for synthesis of fatty acids - which are sent off to the big storage depots.

Show Submitted Answer | Show Correct Answer | Check My Answer

10.4 Nutrient Functions in Disease Prevention & Regression

Learning Outcomes

- Identify nutrients by their disease preventative or treatment function
- Explain how dietary factors can help to minimize oxidation and inflammation
- Identify the nutrients involved in lipid-lowering
- Describe the role of sodium in reducing hypertension

Strong scientific evidence indicates that diet can be a potent weapon in the fight against disease. Calorie restricted diets that yield weight reduction can lead to many cardio-protective and cancer preventative outcomes. Body fat reductions improve insulin sensitivity and glycemic control which, in turn, downgrade the risks of developing pre-diabetes and type 2 diabetes. Diets that champion fruit and vegetable intake are consistently associated with declines in coronary heart disease (CHD), stroke, myocardial infarction and ischemic stroke risks. High fruit and vegetable diets are also characterized by fewer cases of cancers of the oral cavity, esophagus, stomach, colon and rectum.

Antioxidation

Diets that are high in antioxidants may be disease protective. **Antioxidants** are the chemicals that interact with and neutralize free radicals, which prevents the latter from damaging cells and their molecular structures. While the body makes some of the antioxidants that it uses to neutralize free radicals, it also relies on external antioxidant sources that are provided through the diet. **Vitamin E and vitamin C** are the most abundant anti-oxidants in the diet. They work synergistically with the most abundant endogenous antioxidant, glutathione, to protect cell membranes, organelles and DNA from oxidative damage and stress.

Green tea and the predominant **polyphenols** therein, especially EGCG and ECG, may promote substantial free radical scavenging activity to protect cells from DNA damage caused by reactive oxygen species. Intake levels of total flavonoids from other families, such as the **anthocyanins**, have also been associated with reduced concentrations of oxidative stress biomarkers. **Coenzyme Q10** is another compound that can be made inside the body and obtained from food and dietary supplements. It functions as an antioxidant in cell membranes to inhibit LDL oxidation although, to what extent it actually neutralizes oxidative stress, is the subject of continuing research.

Anti-Inflammation

Anti-inflammatory diets are associated with reduced risk of cardiovascular disease and ischemic stroke, as well as reduced cancer promotion. These diets are low glycemic, low in saturated and polyunsaturated fats, and rich in omega-3 fatty acids. They usually elicit a **conservative insulin response**, which favors the conversion to the anti-inflammation eicosanoid EPA, instead of the pro-inflammatory one arachidonic acid. Consuming around two servings of omega-3 rich fish per week or, alternatively, 300-500 mg/day of EPA + DHA supplements may favor lower incidences of fatal myocardial infarction and sudden cardiac deaths, and foods rich in anthocyanin like red wine, apples and strawberries may reduce the pro-inflammatory response by targeting and disabling acute-phase reactant proteins. Supplemental resveratrol may also improve the profile of circulating inflammatory markers, at least temporarily, and may **reduce pro-inflammatory gene expression**.

Blood Pressure Lowering

Even a modest **salt reduction** in the diet totaling less than one teaspoon per day can decrease **systolic and diastolic** blood pressure in individuals with and without hypertension. Low sodium is the cornerstone of the Dietary Approaches to Stop Hypertension (DASH) diet, although it also emphasizes the importance of consuming ample amounts of potassium rich fruits and vegetables. A series of studies have demonstrated significantly lower blood pressure can result from as little as several weeks of high fruit and vegetable intake featuring at least eight servings per day.

Interest in garlic and its potential to prevent cardiovascular disease began with observations that people living near the Mediterranean basin had lower mortality from cardiovascular disease. The **bioactive**

organosulfur compounds in garlic may increase the production of nitric oxide, allowing gaseous signaling to appropriately relax blood vessels. Garlic compounds may also inhibit the growth and migration of vascular smooth muscle cells, a feature of advanced atherosclerotic lesions, by disrupting platelet aggregation and plaque formation. While no serious side effects of supplemental garlic have been reported, the body of scientific evidence regarding the effect of garlic on hypertension is not yet fully developed and requires further research.

Lipid-Lowering

Individuals adhering to plant-based diets high in monounsaturated oils, like the Mediterranean diet, have consistently lower incidences of cardiovascular disease than others following a typical western diet comprised of higher levels of saturated fats. Replacing saturates with monounsaturates as the primary dietary fat source improves the **blood lipid profile** chiefly through a reduction in LDL cholesterol levels.

Low glycemic index (GI) diets that are also high in fiber can yield significant reductions in total cholesterol and LDL-cholesterol levels. People who are insulin resistant and have type 2 diabetes have benefitted from increased fiber intake from foods and viscous fiber supplements as they tend to improve markers of glycemic control and serum lipid profiles. High fiber diets (>20 g/1,000 kcal) and diets high in soluble fiber from flaxseeds, oats and beans have also been shown to modulate total and LDL-cholesterol favorably. The low glycemic foods may reduce serum cholesterol through a reduction in the expression of the gene coding for HMG-CoA reductase, the rate-limiting enzyme in cholesterol synthesis. Diets rich in these foods also provides folate, which can help to maintain **healthy homocysteine** levels.

The introduction of **plant sterols** in whole soy to high saturated fat diets may blunt LDL levels in high-risk patients who have insufficient responses to statin therapy. Among the most cardio-protective foods (in terms of sterol content) are nuts, specifically peanuts and pistachios, which have a fat profile mirroring the high monounsaturated fat profiles known to reduce LDL cholesterol. Plant sterols may also elicit a modest reduction in arterial stiffness and impaired arterial distensibility—surrogate markers of vascular damage. Phytosterols promote increased disposal of cholesterol by binding to bile, which makes it unavailable as an emulsifier during digestion, so that the liver makes more bile using cholesterol that is circulating through the bloodstream.

Certain **flavonoids** are associated with modest reductions in cardiovascular risk. For example, green tea catechins, mainly EGCG, have been linked with a reduced cholesterol-to-HDL ratio, which many believe is a stronger predictor of cardiovascular risk than LDL alone. **Cocoa** is a source of flavan-3-ols that may provide cardiovascular benefits including improvements in lipoprotein profile, yielding higher HDL-cholesterol and lower total and LDL-cholesterol levels. Consuming berries or juices rich in **anthocyanins** may also generate reduced levels of LDL-cholesterol and improved cholesterol clearance via the HDL-mediated reverse cholesterol transport system.

Nutrigenomic

Genetic abnormalities can influence disease risk and the impact of dietary treatment. For example, the association between cruciferous vegetable intake and myocardial infarction events is significant only in individuals with two functional GSTT1 alleles; not in carriers of two alleles of the GSTT1 null variant. Likewise, antioxidant therapy (i.e., consuming 1,000 mg/day of vitamin C plus 800 IU/day of vitamin E) has been shown to improve atherosclerosis in women with two copies of the haptoglobin 1 gene but to worsen it in those with two copies of the haptoglobin 2 gene.

Nutrition can be used to aid those at higher risk of disease onset because of an **existing condition** or health issue. For instance, a **high fiber diet** can be particularly effective at protecting those with a hereditary risk of developing precancerous colorectal polyps. Similarly, a 10 g increase in whole-grain wheat intake has been found to dramatically lower the risk of esophageal cancer. Additionally, for individuals who suffer from colorectal polyps, or adenomas, which are the precursors of most colorectal cancers, calcium supplements may reduce the risk of cancer occurring at the distal part of the colon. Similarly, vitamin C may also be a useful addition to standard Helicobacter pylori (H. pylori) eradication therapy to reduce the risks of gastric and colon cancers. However, for some cancers, vitamin C in high doses may actually alter the effectiveness specific therapies. As such, it is critical that cancer patients inform their doctors about their use of any dietary supplements for possible contraindications.

Anti-Carcinogen

The damaging effects of carcinogens in the gastrointestinal tract are weakened in the presence of several dietary factors. For example, **vitamin C** reduces the formation of N-nitroso compounds (NOCs) in gastric juice and scavenges reactive oxygen metabolites (ROMs) in gastric mucosa. **Fiber** moves fecal matter through the intestines faster, decreasing the contact time between the carcinogen and the intestinal wall, and may even bind to carcinogens to keep them away from the intestinal wall when bowels are stagnant. Fiber also binds bile acids so that they are unavailable for fermentation and fecapentane production, which in turn promotes the colonization of healthy bacteria. **Calcium** may also protect the colon from carcinogens by forming insoluble complexes (i.e., calcium soaps) with bile and fatty acids in the intestines so that neither acid type (or their metabolites) are available for bacterial fermentation, nor oxidation in the lining of the colon.

Anti-Tumor

Some dietary treatments are thought to slow tumor cell proliferation and the rate of tumor protein synthesis. Others are believed to initiate tumor cell death (i.e., apoptosis). Formulas with specialized carbohydrate, amino acid and fatty acid profiles may perturb the tumor cell microenvironment by targeting metabolic weaknesses of tumor cells. For instance, **ketogenic diets** may suppress tumor growth by restricting glucose

that is needed for the tumor to make energy using anaerobic metabolism before adequate vascularization and oxygen delivery. Medium chain triglycerides effectively promote ketogenesis and may impair tumor growth. Good anti-tumor or tumor neutral fats include cocoa butter, a rich source of stearic acid, and walnut, flaxseed and high stearodonic acid soybean oils which are rich in omega-3 fatty acids, particularly alpha-linolenic acid.

Amino acid imbalances may also effectively deprive tumors of needed substrates while providing the host with alternative ketogenic amino acid fuels to offset cancer cachexia and to promote protein synthesis. Since rapidly growing tumors have a greater need for arginine than the body can supply endogenously, and because some tumors lack arginosuccinate synthetase, it is possible that restricting exogenous/dietary arginine could inhibit tumor growth. Many malignant tumors have also been found to express the VDR receptor, suggesting that they might be susceptible to the effects of vitamin D. Experimental studies have demonstrated that biologically active forms of vitamin D and its analogs, upon binding to the tumor's VDR receptor, may inhibit proliferation and/or induce differentiation or death of various cancerous cell types.

Several phytochemical compounds are thought to inhibit tumorigenesis of cancers originating in several tissues. Tea catechins, garlic and **resveratrol** are just a few of the compounds that have shown promise in animal and in vitro studies to inhibit tumor proliferation by inducing apoptosis and obstructing angiogenesis which supports tumor growth and metastasis.

10.4 Homework 1
Review

This phytochemical may exhibit lipid lowering effects.

- A Sterols
- B Flavonoids
- C Anthocyanins
- D All of the above

Explanation

Yes, all of these phytochemical are being evaluated for their role in reducing blood cholesterol levels

Show Submitted Answer | Show Correct Answer | Check My Answer

10.4 Homework 2
Review

Current evidence indicates that reducing disease risk is most effective when saturated fats in the diet are:

- (●) **A** replaced by unsaturated fats
- ( ) **B** replaced by cholesterol
- ( ) **C** replaced by high glycemic carbohydrates
- ( ) **D** restricted to less than 30% of total calories

Explanation

Correct, when saturated fats are replaced by UNSATURATED fats, disease risk is reduced. The other two replacement options (high-glycemic foods and cholesterol) are incorrect and 30% of calories from saturated fat is much too high a percentage

Show Submitted Answer | Show Correct Answer | Check My Answer

10.5 NUTRIENT STATUS MEASURES IN EVALUATING DISEASE

Learning Outcomes

- Identify at risk values for waist circumference, blood cholesterol, hyperglycemia and blood pressure levels
- Explain what an occult blood test is and what type of cancer it detects
- Describe the screening and diagnostic tests for heart disease

There are a wide variety of assessments that are used to evaluate disease status. Disease risk is ideally identified in health screening, which usually includes a series of anthropometric, clinical and biochemical measures such as weight, blood pressure and cholesterol. Diagnostic assessments may also include tissue biopsies, tests of tolerance and high-tech imaging.

Anthropometric Screening

Risk screening for most diseases rely on measures of anthropometry. The most common anthropometric measure is the body mass index (BMI), which assesses

body weight and height. A stronger predictor of disease risk, though, specifically those related to metabolic syndrome abnormalities is **waist circumference**. Waist circumferences exceeding 39-43 inches for men and 39-47 inches for women are associated with greater risks for many disease types including cardiovascular disease and cancers of the esophagus, colorectal, prostate and breast tissues. Excess body fat in the visceral, or waist, area is also linked with increased risk of high blood pressure, a factor positively related to the development of kidney cancer. Waist circumferences of 31-39 inches for men and 27-35 inches for women, depending on frame size, are typically considered healthy and disease preventative.

Clinical and Biochemical Disease Screens

High blood pressure greatly increases the risk of heart
disease and stroke. Persisting higher pressure in the vessels can also lead to cancers of the kidney and may damage the endothelial lining so that angiogenesis may favor cancer tumor growth. Blood pressure screenings are typically performed once every two years for healthy adults whose blood pressure is less than 120/80 mm Hg. Adults whose blood pressure measures over 120/80 are labeled "pre-hypertensive," and those with measures over 140/90 are diagnosed with "hypertension."

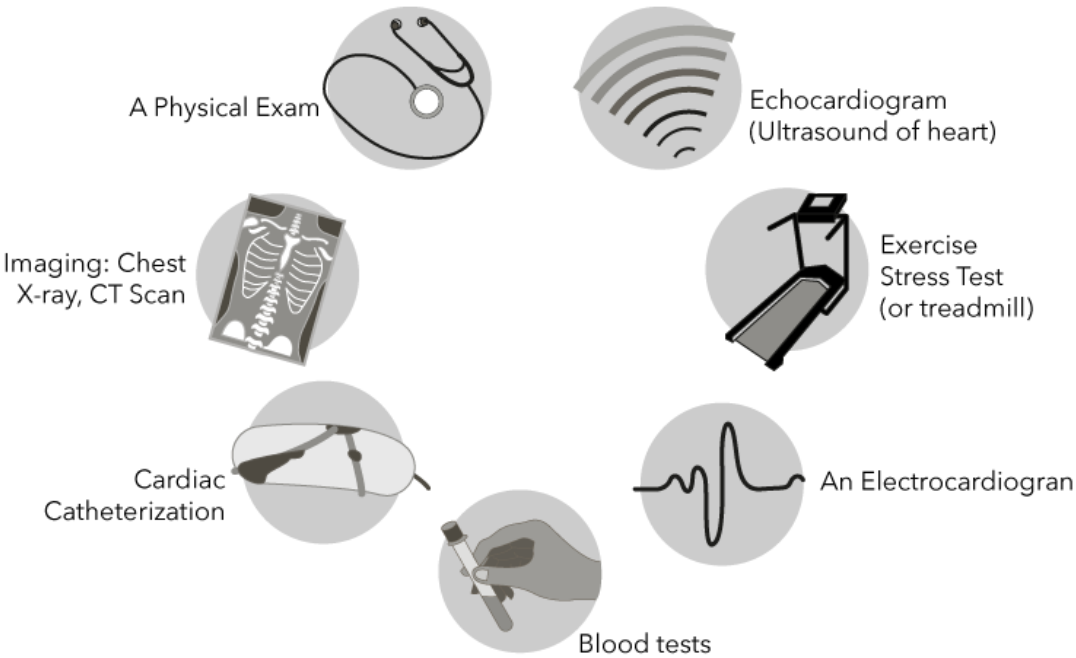
Fasting blood cholesterol measures are taken every 4-6 years, starting at age 20, or more frequently if an individual is at an increased risk for CVD or stroke. Cholesterol is measured using a blood sample that is analyzed for total cholesterol and the cholesterol fractions, called lipoproteins. Total cholesterol is calculated by adding VLDL, which is actually a measure of serum triglycerides, together with LDL, which is a product of VLDL metabolism as it circulates, and HDL levels. A healthy lipid profile is less than 200 mg/dL total cholesterol, less than 130 mg/dL LDL, and at least 60 mg/dL HDL. Another valuable cholesterol measurement is the ratio of total cholesterol to HDL, expressed as TC:HDL, which should be less than 3.5 and 3.0 for men and women, respectively.

The American Diabetes Association (ADA) recommends regular screens for **diabetes risk** starting at age 45, with successive tests to follow every 3 years thereafter. Fasting blood glucose, glucose tolerance, and glycated hemoglobin measures are taken to estimate risk of prediabetes or diabetes. For those diagnosed with diabetes, while blood and urine glucose and urine ketone testing provide useful information for day-to-day management of diabetes, these tests cannot provide a quantitative and reliable measure of glycemia over an extended period of time. Measurements of glycated proteins, primarily hemoglobin and serum proteins, **A1c levels (A1c %)**, with a single measurement, can quantify glycemia over months, which complements day-to-day testing. According to the ADA, diabetes therapies should strive to achieve A1C measurements of less than 7%.

Adenoma screens are performed every 5-10 years in patients aged 50-70 years by colonoscopy or other imaging method, such as CT colonography. These tests examine the structure of the colon itself in search of abnormalities. Polyps found during these tests can be removed before they become cancerous.

Fecal blood tests that detect hidden, or occult, blood in the stool are also conducted during annual screens but they are less likely to detect polyps. Hidden blood in the stool is one of the least invasive measures of colon cancer. Blood vessels in larger colorectal polyps or cancers are damaged by the passage of stool which causes bleeding into the colon. Rarely is there enough bleeding to be visible so chemical and biological assays, such as the guaiac-based fecal occult blood test (gFOBT) and the fecal immunochemical test (FIT), are usually performed to detect occult blood in the stool. If these tests are positive, a colonoscopy can be performed to determine the cause of the bleeding as it could be cancer or polyps, or non-cancerous causes like ulcers, hemorrhoids, diverticulosis (i.e., tiny pouches that form at weak spots in the colon wall) or inflammatory bowel disease (i.e., colitis).

Diagnostic assessments for cardiovascular disease include a number of image tests such as cardiac computed tomography (CT scan), cardiac magnetic resonance imaging (MRI), and chest x-rays that take detailed pictures of the heart and blood vessels. Coronary angiography, also known as an angiogram, is a different diagnostic procedure that uses contrast dye and x-ray pictures to look at the insides of arteries to diagnose heart diseases after chest pain, sudden cardiac arrest or abnormal results from heart tests like EKGs or a stress tests. A stress test is another type of diagnostic assessment which imposes physical stress by exercise (or medicine if exercise is not possible), and then monitors the heart's electrical activity and rate, and whether its rhythm is steady or irregular.



10.5 Homework 1
Review

Ideal levels of glycosylated hemoglobin are:

Targets placed: 1/1

Undo Delete selected Remove All

You can place up to 1 targets

Explanation

Yes, ideal is less that 7%- this shows glycemic control over long-term

Show Submitted Answer Show Correct Answer Check My Answer

10.5 Homework 2
Review

What do occult-type cancer screens detect?

- A metastasized tumors
- B blood in stool
- C tumor size
- D gene mutations

Explanation

Yes, this type of cancer screens uses fecal samples to look for occult blood

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