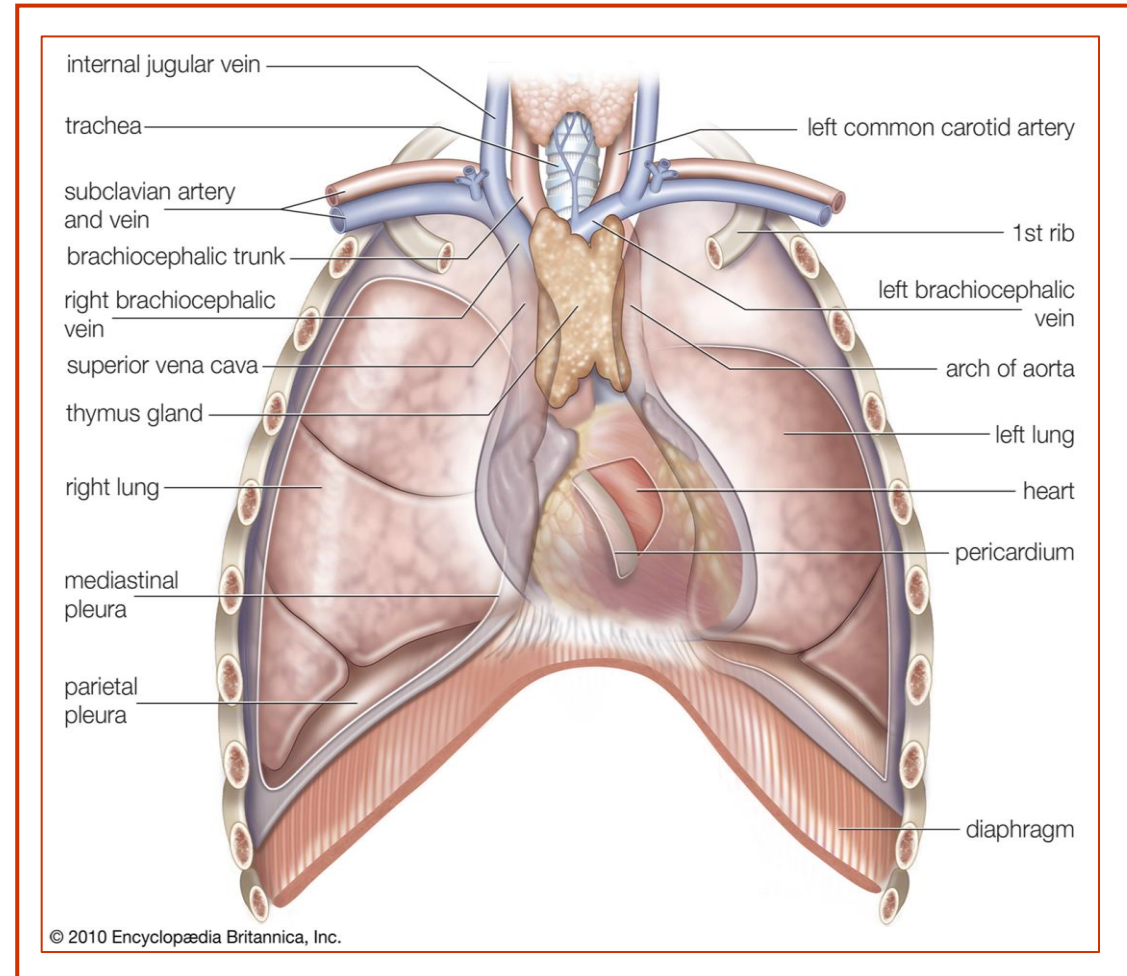


Cardiology and Healthy Living

Spring 2022

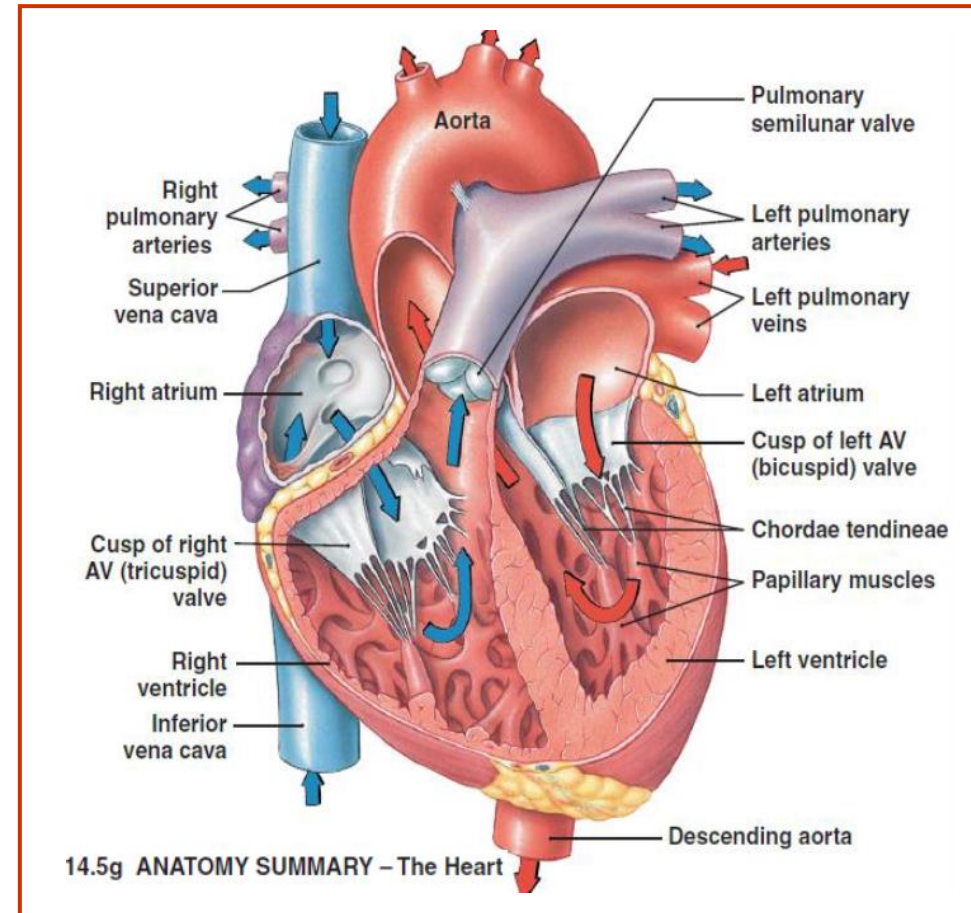
The Heart

- Muscular organ located in the thorax, between the lungs and above the diaphragm
- Roughly the size of an adult fist
- Pumping about 2,000 gallons of blood volume daily



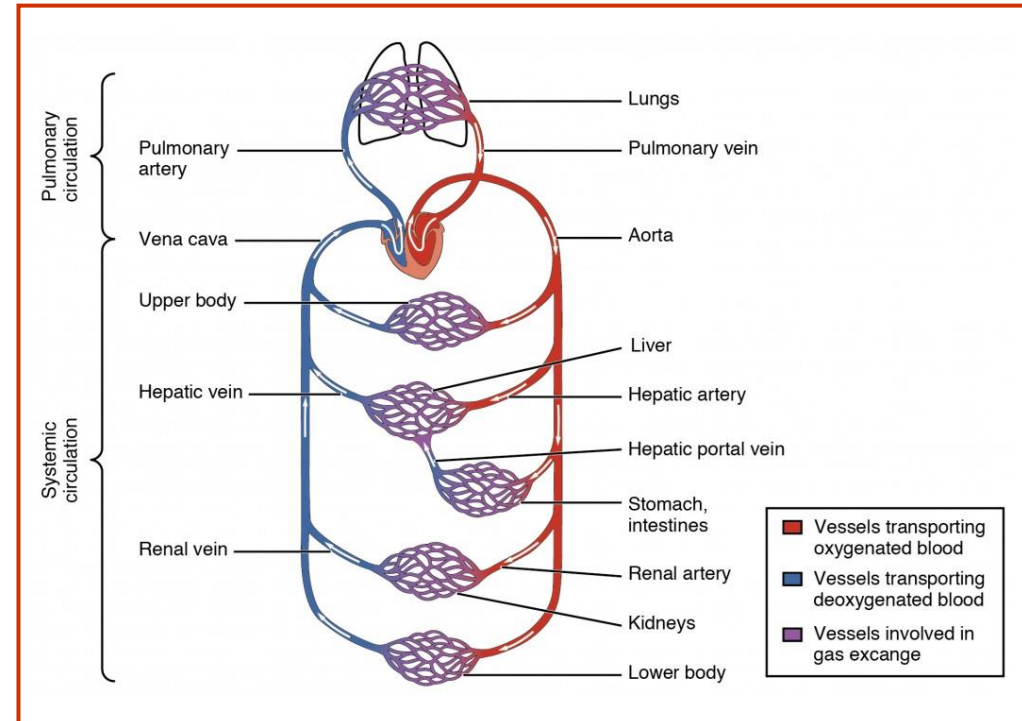
Anatomy of the Heart

- Divided into 4 chambers
 - 2 atria (right atrium and left atrium) at the top
 - 2 ventricles (right ventricle and left ventricle) at the bottom
- Atria receive blood into the heart, while ventricles pump blood out of the heart
- Chronologically, blood flows from vena cava → right atrium → right ventricle → pulmonary arteries → lungs → pulmonary veins → left atrium → left ventricle → aorta
- Chambers of the heart are separated by 4 valves that ensure unidirectional blood flow



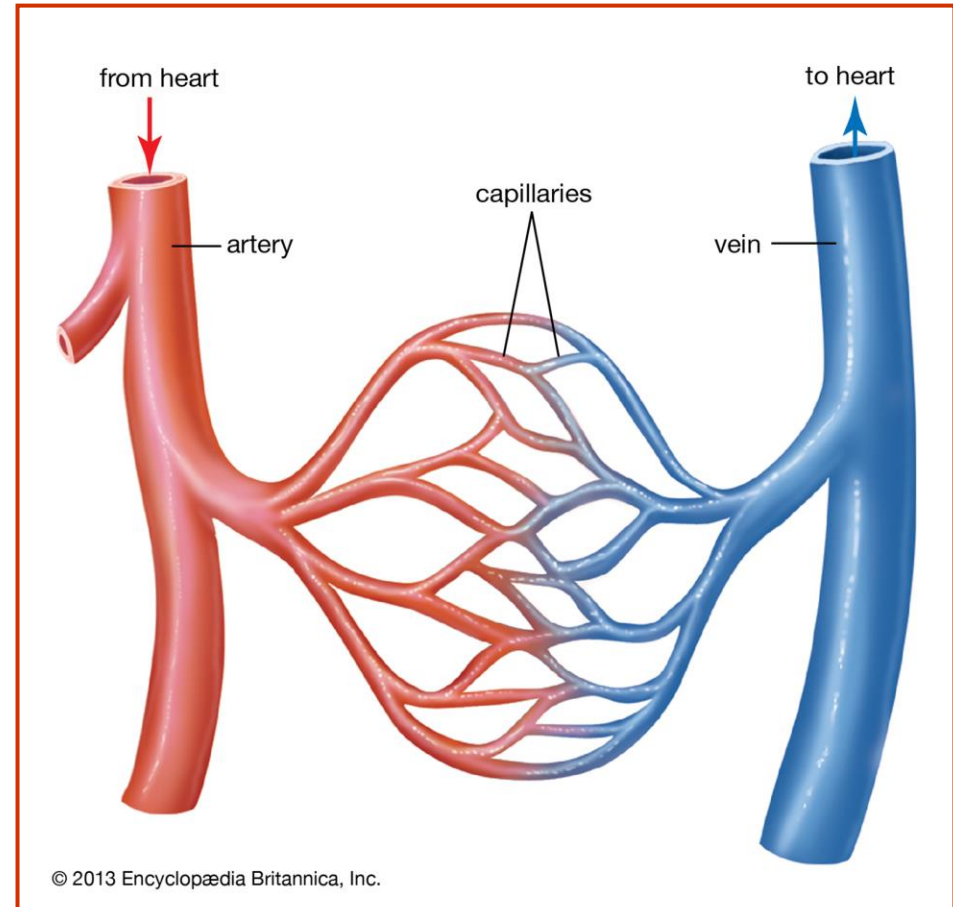
Cardiac Circulation

- **Systemic circulation:** allows blood to flow to and from the rest of the body
 - Heart (left ventricle) → aorta → rest of body → veins → vena cava → back to the heart (right atrium)
- **Pulmonary circulation:** allows blood flow between the heart and the lungs
 - Heart (right ventricle) → pulmonary arteries → lungs → pulmonary veins → heart (left atrium)



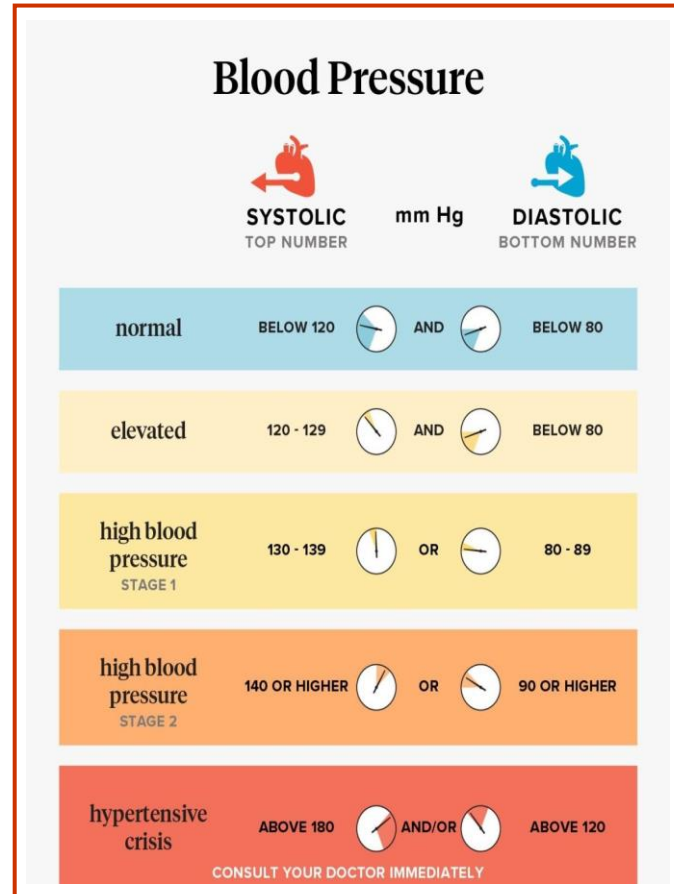
Vasculature

- If you took all the blood vessels of an average adult out and laid them in one line, the vasculature would:
 - Stretch ~100,000 miles
 - Wrap around the circumference of the earth ~4 times
- There are three kinds of blood vessels:
 - **Arteries**: Carry blood **away** from the heart
 - **Veins**: Carry blood **toward** the heart
 - **Capillaries**: Very small. Deliver and absorb oxygen, nutrients, and other solutes to tissues throughout the body
- All **arteries** carry **oxygenated** blood (except for the pulmonary arteries)
- All **veins** carry **deoxygenated** blood (except for the pulmonary veins)



Blood Pressure and Heart Rate

- Blood Pressure (BP): the force of blood pushing against vessel walls that maintains circulation
 - Measured as a ratio of systolic over diastolic pressure (ex. 120/80)
 - **Systolic**: BP during contraction of the heart
 - **Diastolic**: BP during relaxation of the heart
- Heart Rate (HR): # of times the heart beats per minute
 - The heart beats ~100,000 times daily and ~2.5 billion times in the average person's lifetime



Resting Heart Rate Chart

Men (beats per minute)

Age	18 - 25	26 - 35	36 - 45	46 - 55	56 - 65	65 +
Athlete	49 - 55	49 - 54	50 - 56	50 - 57	51 - 56	50 - 55
Excellent	56 - 61	55 - 61	57 - 62	58 - 63	57 - 61	56 - 61
Great	62 - 65	62 - 65	63 - 66	64 - 67	62 - 67	62 - 65
Good	66 - 69	66 - 70	67 - 70	68 - 71	68 - 71	66 - 69
Average	70 - 73	71 - 74	71 - 75	72 - 76	72 - 75	70 - 73
Below Average	74 - 81	75 - 81	76 - 82	77 - 83	76 - 81	74 - 79
Poor	82 +	82 +	83 +	84 +	82 +	80 +

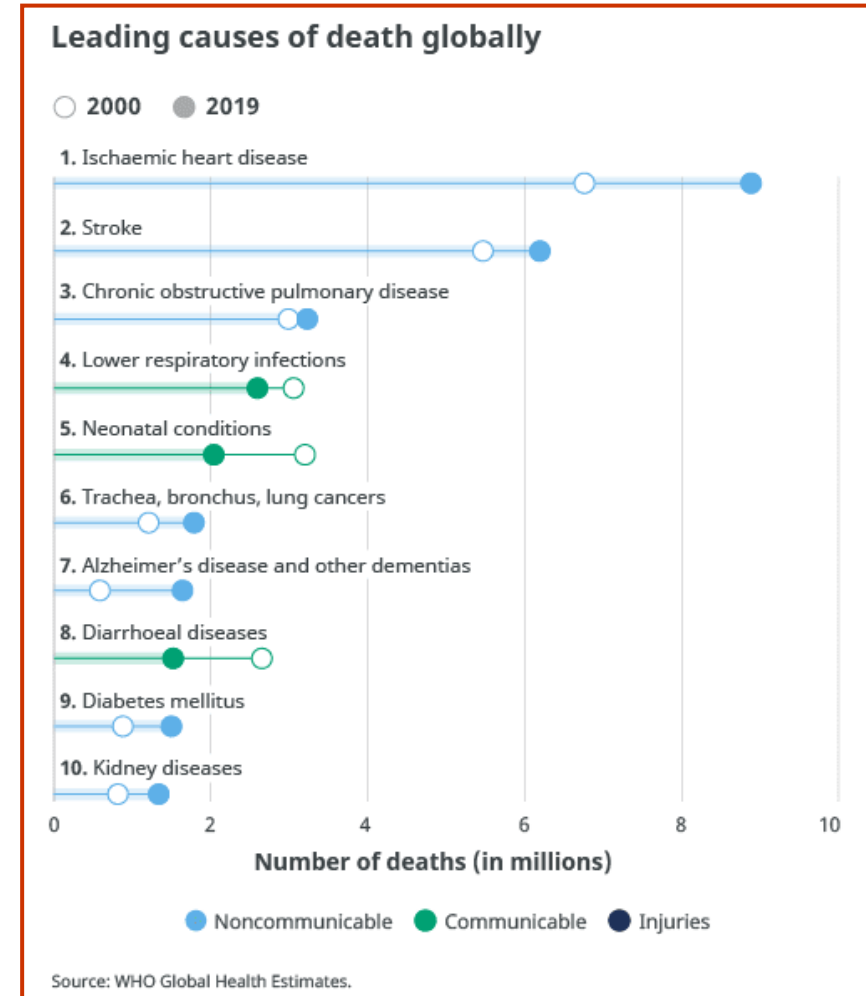
Women (beats per minute)

Age	18 - 25	26 - 35	36 - 45	46 - 55	56 - 65	65 +
Athlete	54 - 60	54 - 59	54 - 59	54 - 60	54 - 59	54 - 59
Excellent	61 - 65	60 - 64	60 - 64	61 - 65	60 - 64	60 - 64
Great	66 - 69	65 - 68	65 - 69	66 - 69	65 - 68	65 - 68
Good	70 - 73	69 - 72	70 - 73	70 - 73	69 - 73	69 - 72
Average	74 - 78	73 - 76	74 - 78	74 - 77	74 - 77	73 - 76
Below Average	79 - 84	77 - 82	79 - 84	78 - 83	78 - 83	77 - 84
Poor	85 +	83 +	85 +	84 +	84 +	85 +

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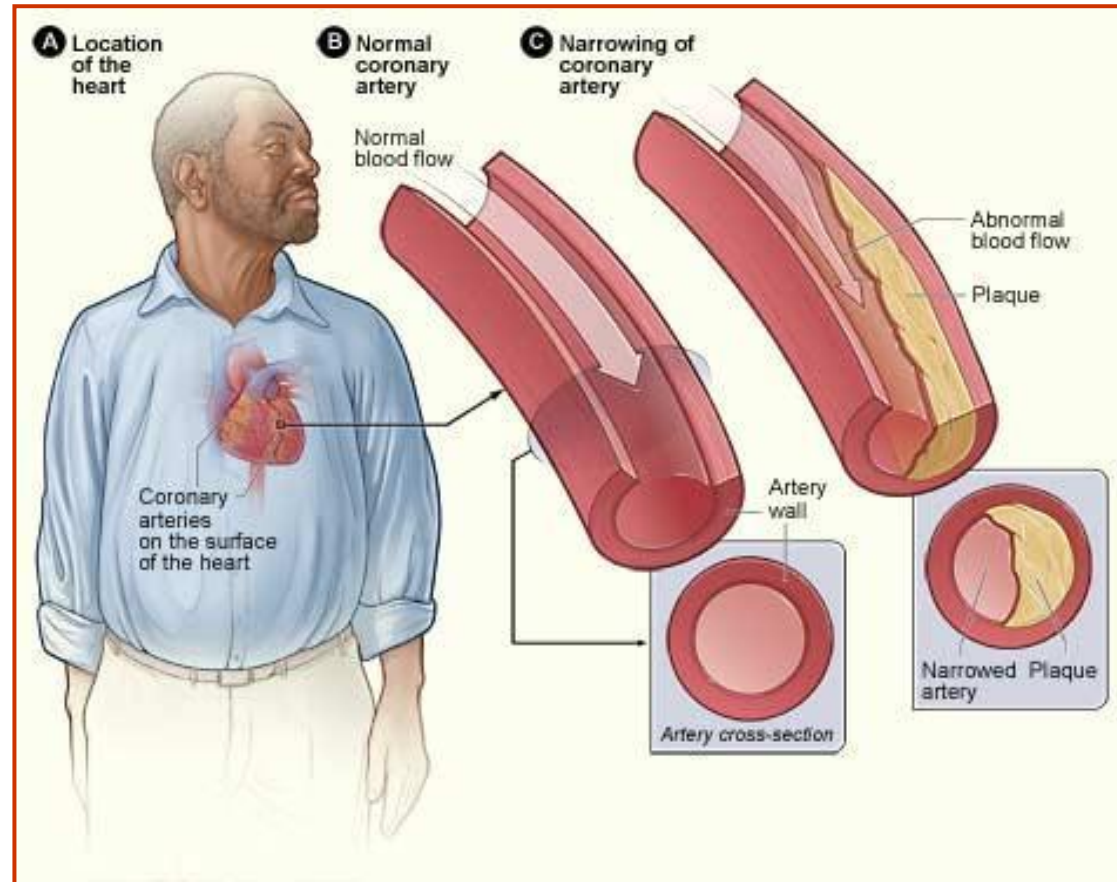
Cardiovascular Disease

- Cardiovascular disease (heart disease) has consistently been the leading cause of death around the world for decades
- “Cardiovascular disease” is an umbrella term that includes a number of diseases of the heart and blood vessels



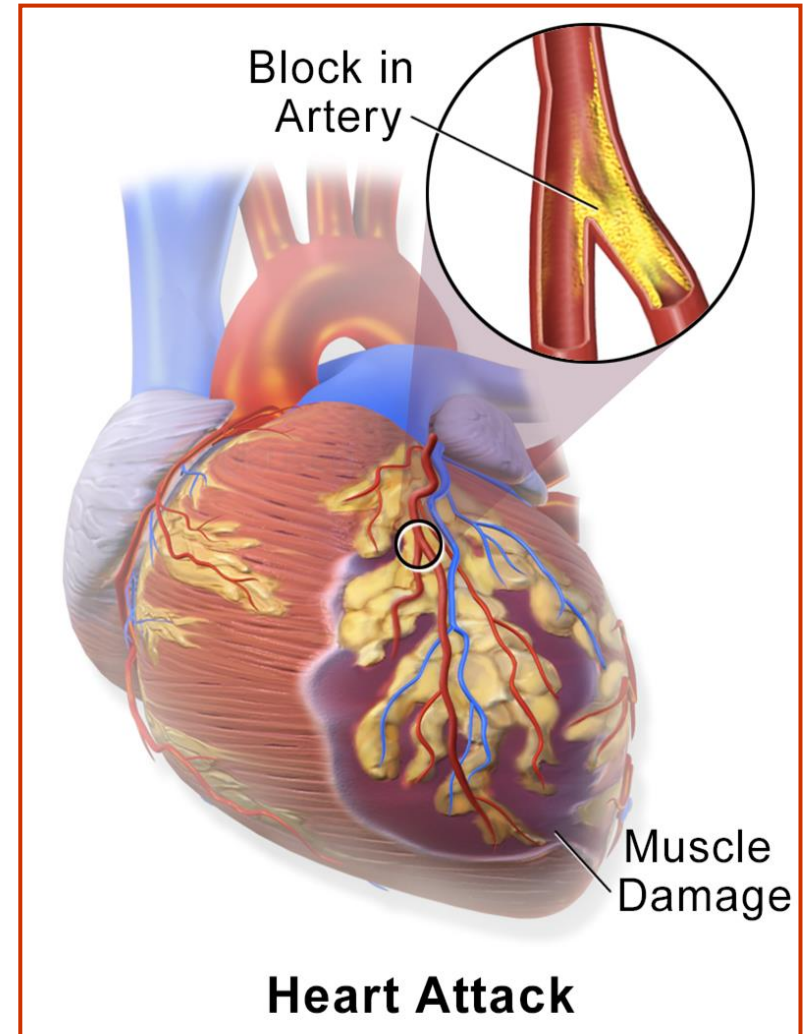
Coronary Artery Disease (CAD)

- Plaque build-up (atherosclerosis) in the walls of the arteries supplying the heart (the coronary arteries)
- Most common type of heart disease
- Often due to high cholesterol

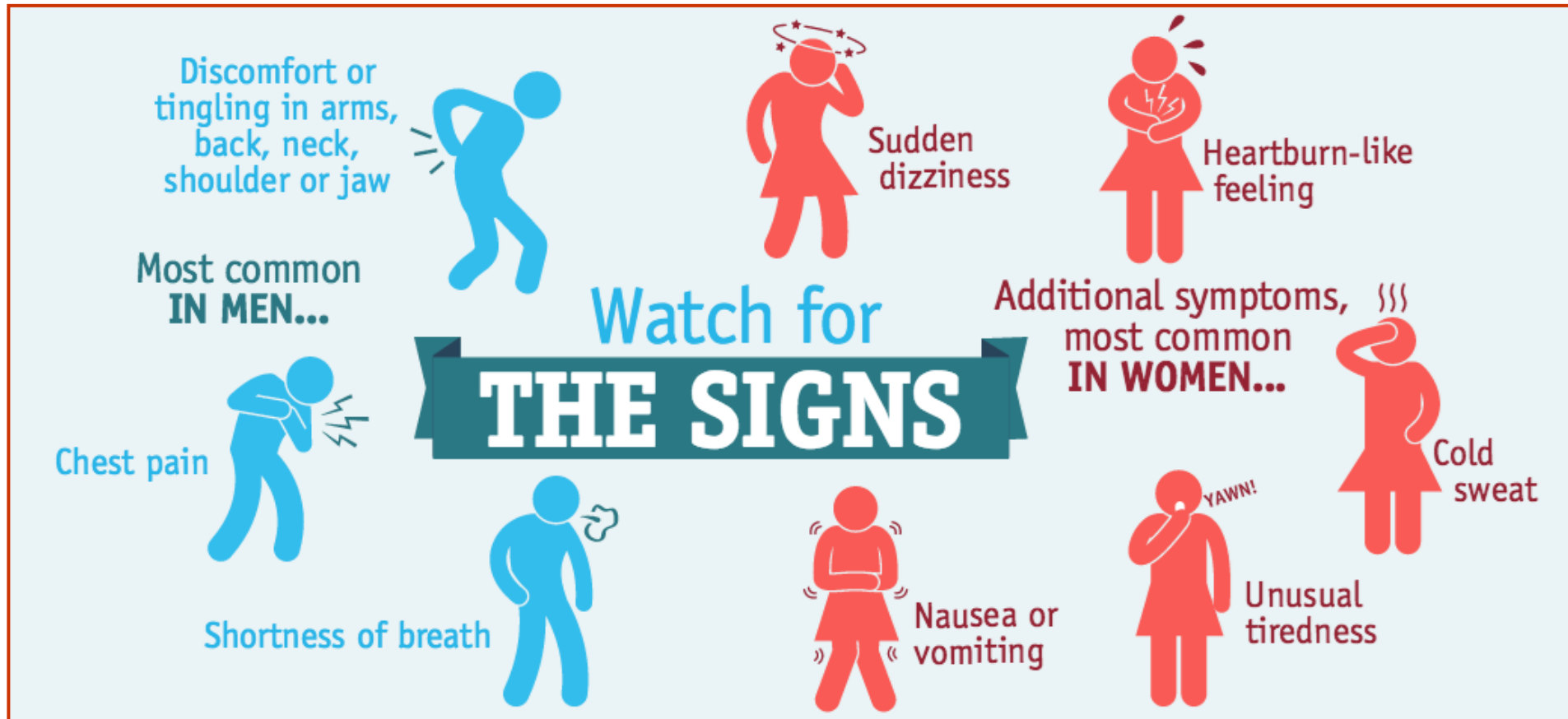


Myocardial Infarction (Heart Attack)

- When blood flow to a portion of the heart decreases or is blocked, the heart is not getting the oxygen it needs to work properly
 - Leads to damage to the cardiac muscle
 - **Ischemia** = blocking of blood flow to an organ
- Commonly caused by coronary artery disease (CAD)
- Can lead to:
 - **Arrhythmia**: irregular heart beating
 - **Cardiac arrest**: acutely the heart fails to pump blood effectively stopping the flow of blood systemically (often fatal)
 - **Congestive heart failure**: chronically the heart fails to pump blood sufficiently such that blood flow to body tissues does not meet metabolic need



Symptoms of MI: Men vs. Women

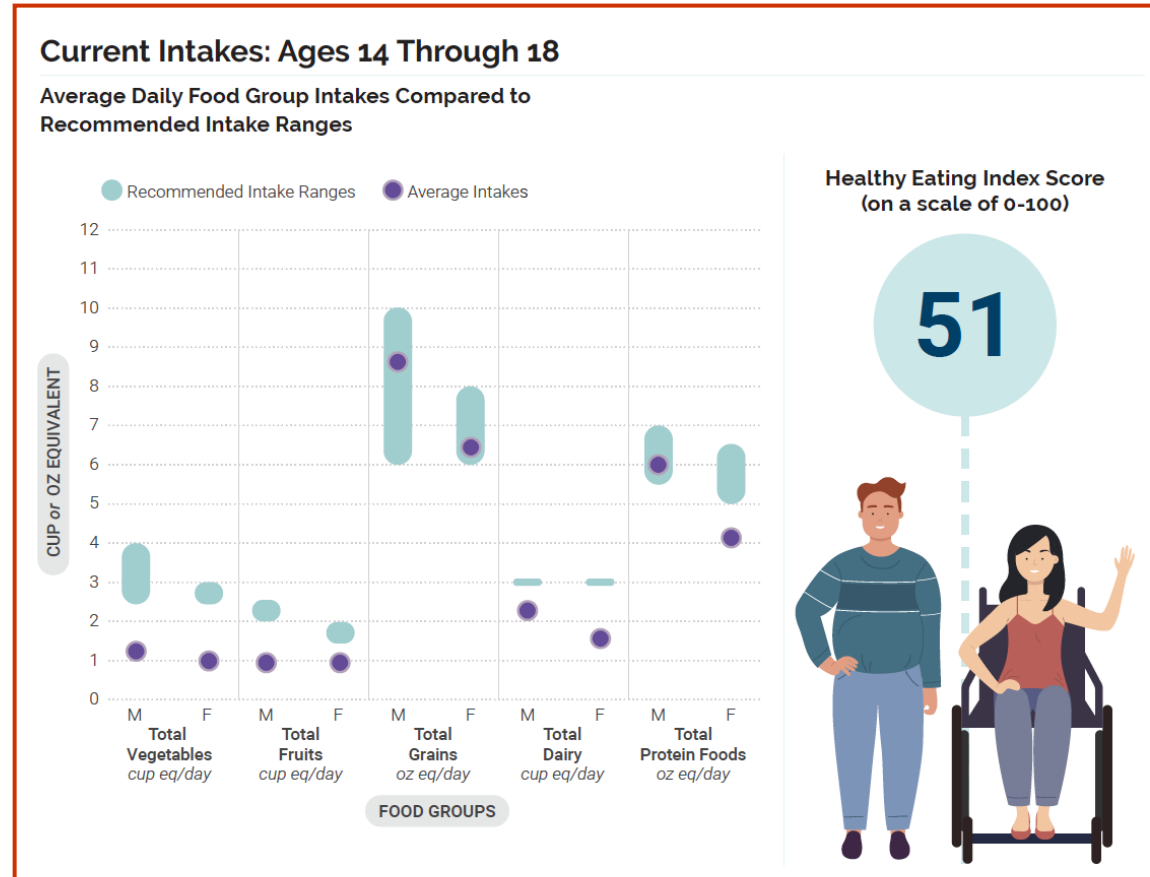


Healthy Living

- Many behaviors and lifestyle factors can have a significant impact on an individual's risk for heart disease.
- *What are some behaviors that you think could affect someone's cardiovascular health (for better or worse)?*

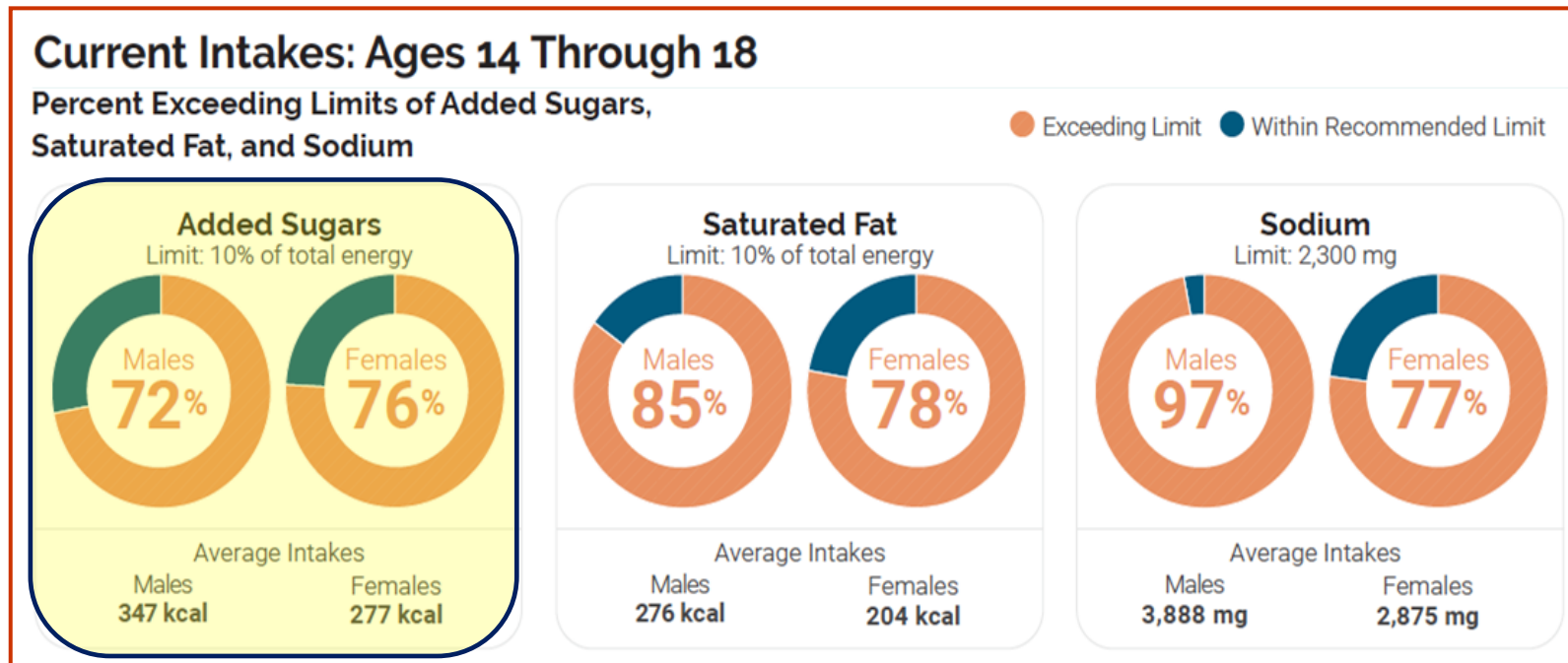
Healthy Dietary Intakes

- The major food groups include:
 - Fruits
 - Vegetables
 - Grains
 - Protein
 - Dairy
- *According to the chart, which food groups do 14-18 consume a sufficient amount of? Which do they not consume enough of?*



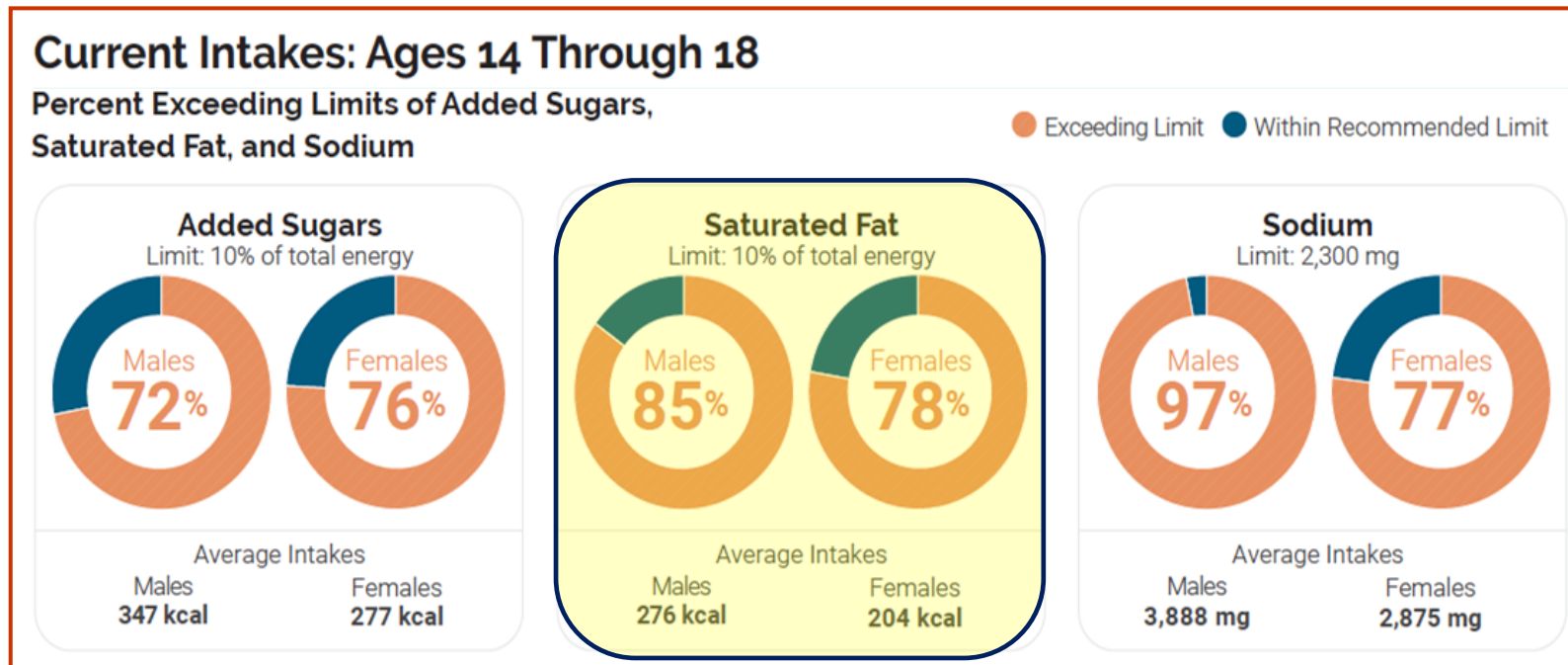
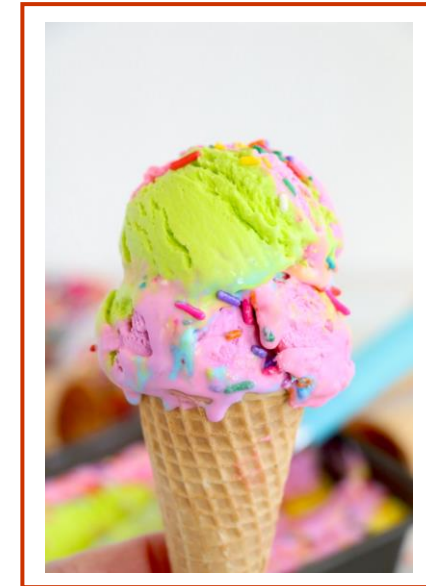
Excessive Dietary Intakes

- On average Americans overconsume:
 - **Sugar**
 - Saturated fat
 - Sodium



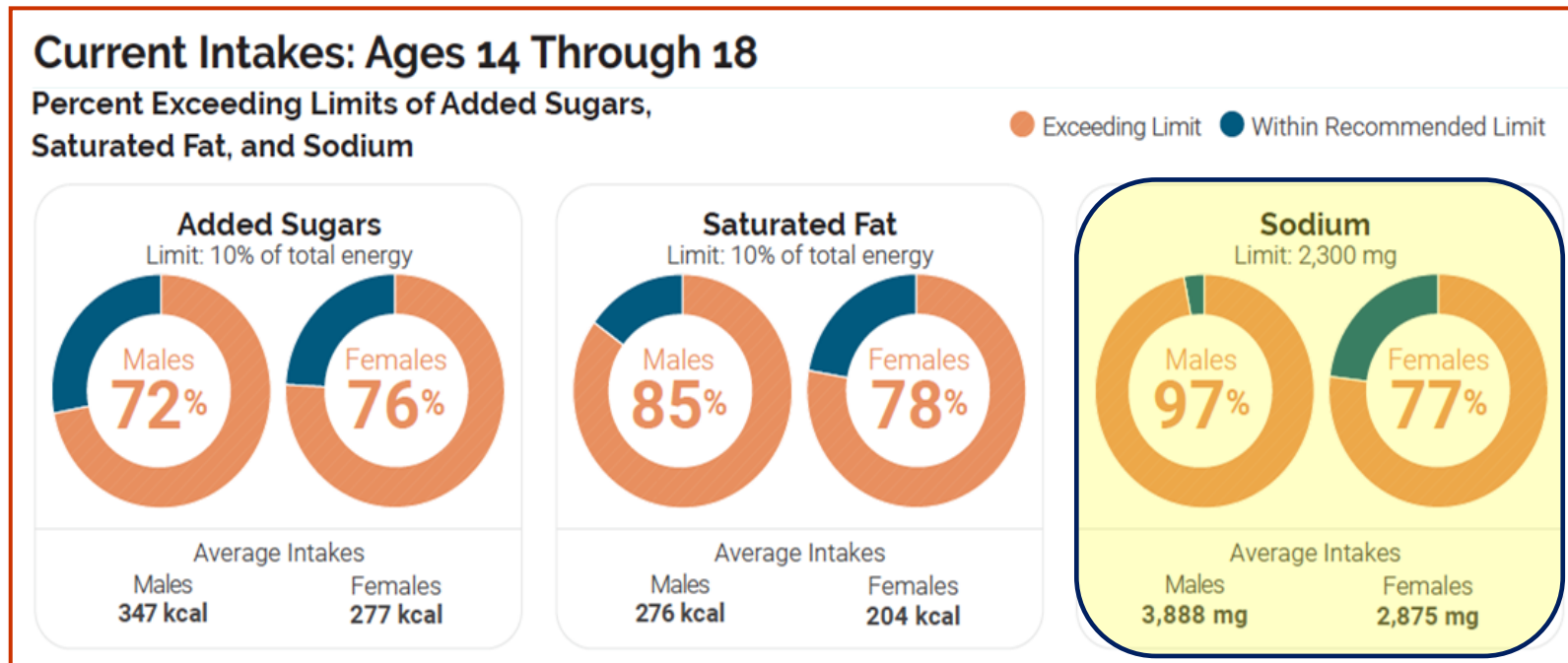
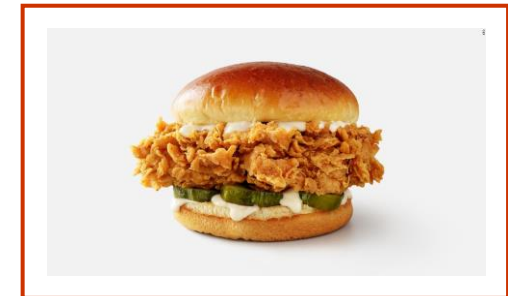
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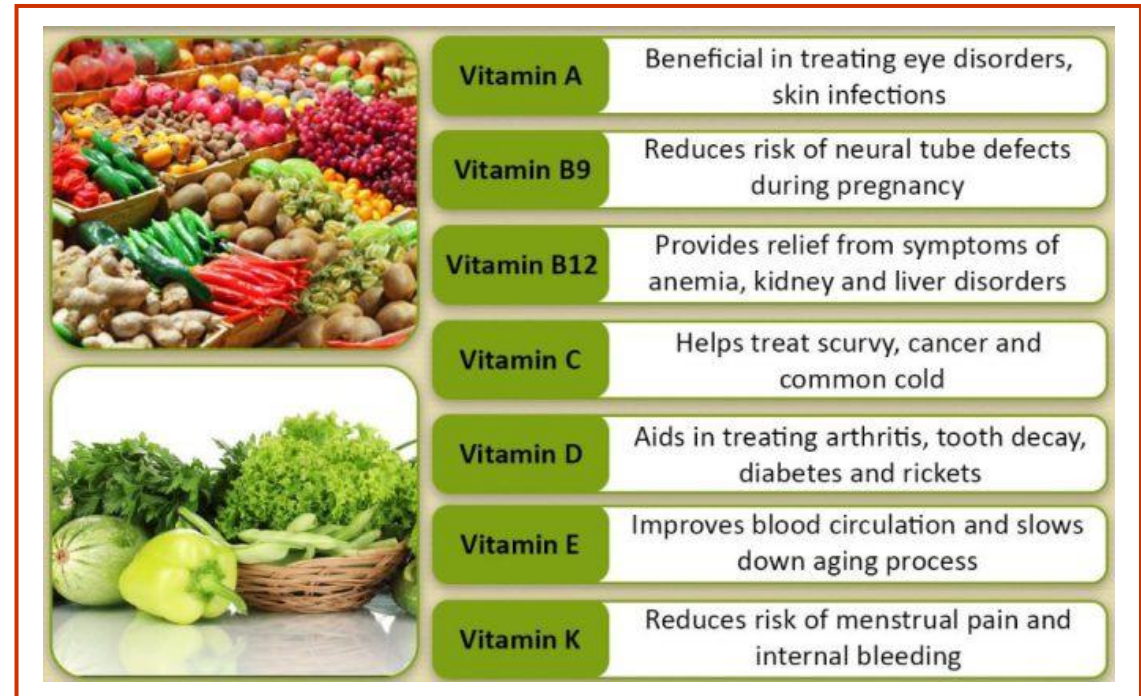
Excessive Dietary Intakes

- On average Americans overconsume:
 - Sugar
 - Saturated fat
 - **Sodium**



Weight Loss and Diets

- All weight loss and weight gain follows a simple equation
 - Caloric Deficit = (calories consumed) – (calories burned)
- If you burn more calories than you eat you will lose weight; if you eat more calories than you burn, you will gain weight
- In addition to number of calories, the **types** of food you eat also matter:
 - Eating 1,000 calories of pasta leads to the same caloric deficit as eating 1,000 calories of vegetables
 - However, the pasta doesn't contain the necessary vitamins and minerals that the vegetables do



Weight Loss and Diets



- Many popular diets feature the use of some biochemical principle
 - E.g. the "keto diet" forces the body to use molecules called ketones for energy
- However, regardless of the biochemical principle, if weight loss occurs it is because of a caloric deficit
- Make sure to check with a doctor or dietician before trying a new diet. Be wary of diets that force your body into some abnormal physical or chemical state

Diet name	Short description	How it works
Low carb	Eat fewer carbs and more foods rich in protein and fats	By creating a caloric deficit
Ketogenic	Eat almost no carbs, some protein and mostly fats	By creating a caloric deficit
Paleo	Eat only minimally processed "paleolithic" foods	By creating a caloric deficit
Low fat	Avoid foods high in fats and eat mostly protein and carbs	By creating a caloric deficit
Intermittent fasting	Restrict your eating period to only a few hours every day	By creating a caloric deficit
Weight watchers	Points based system to help with portion control	By creating a caloric deficit
Very Low Calorie Diet	Eat all nutrients but limit energy intake to 800 kcal	By creating a caloric deficit
Juice diet	Consume only fruit and vegetable juices while abstaining from solid food consumption	By creating a caloric deficit
Raw food diet	Eat raw foods only	By creating a caloric deficit

Organic Foods

- Organic foods are produced without:
 - Chemical fertilizers
 - Synthetic pesticides (use natural pesticides instead)
 - Genetically modified organisms (GMOs)
 - Chemical food additives
 - Artificial growth hormones/ Antibiotics
- Studies have yet to definitively prove any **clear, clinically relevant nutritional differences** between organic and conventional food.
- Other reasons people may choose organic foods include:
 - Lower levels of detectable pesticides in organic food (but levels in conventional foods are low to begin with)
 - More humane/natural conditions for farm animals

4 TRUTHS ABOUT ORGANIC FOOD THAT EVERYONE NEEDS TO KNOW

Organic food is NOT pesticide free.



Both organic & conventional farms are a mix of small and large scale operations.



Organic crops aren't necessarily better for the environment and in some cases they're worse.

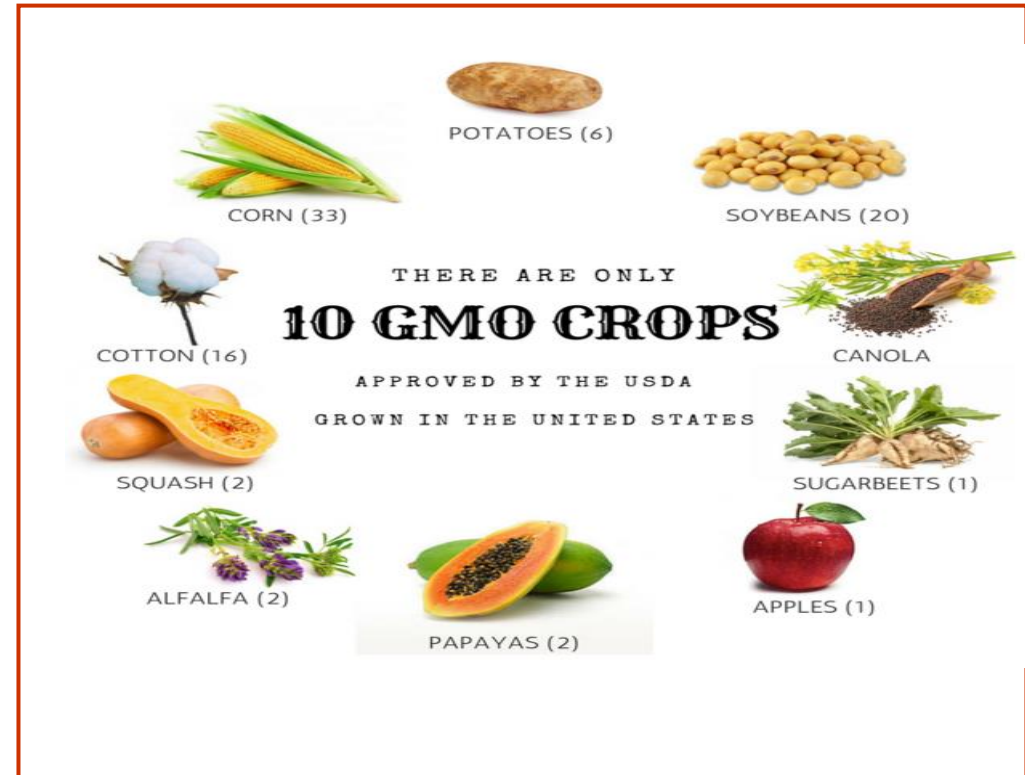


Just because it's organic, it doesn't mean it's healthier or more nutritious.



Genetically Modified Organisms

- GMO: a plant, animal, or microorganism that has had its genetic material (DNA) changed using technology that generally involves the specific modification of DNA.
- Commonly added traits:
 - Herbicide tolerance
 - Insect resistance
 - Drought tolerance
 - Prevent browning
 - Reduce natural toxins
 - Ex. Acrylamide is a natural chemical in potatoes with neurotoxic and carcinogenic potential, so we use genetic modification to reduce acrylamide production in the potatoes, so they are safe to eat.



Benefits of Aerobic Exercise

- Strengthens the heart muscle
- Aids in maintaining a healthy weight
- Increases blood flow systemically
- Decreases risk of developing heart disease
- Endorphins are released that improve mood



MOVE YOUR WAY Adults need a mix of physical activity to stay healthy.

Moderate-intensity aerobic activity*
Anything that gets your heart beating faster counts.

at least **150 minutes a week**

Muscle-strengthening activity
Do activities that make your muscles work harder than usual.

at least **2 days a week**

AND

* If you prefer vigorous-intensity aerobic activity (like running), aim for at least 75 minutes a week.

If that's more than you can do right now, **do what you can.** Even 5 minutes of physical activity has real health benefits.

Walk. Run. Dance. Play. **What's your move?**

Medical Ethics Case Study – Patient Presentation

- Ms. Simpson is a 58-year-old woman who presents with dyspnea (difficulty breathing), dizziness, and pressure in her chest for the last two hours.

- *What are some possible causes of Ms. Simpson's symptoms?*

Medical Ethics Case Study – Diagnosis and Treatment

- Ms. Simpson's symptoms are typical for a myocardial infarction (heart attack).
- She is administered oral aspirin that is chewed and an anticoagulant called heparin that is administered intravenously.
- *Why was the aspirin chewed (rather than swallowed whole) in this case?*
- *Anticoagulants (aka blood thinners) help to prevent clot formation; why might that be useful for treating a heart attack?*

Medical Ethics Case Study – Patient History

- After Ms. Simpson is stabilized and properly treated, her physician wants to figure out what might have caused the heart attack, so he performs a more detailed history.
- After talking to Ms. Simpson, the physician notes that she is a 58-year-old woman with hypertension who is overweight and has smoked a pack of cigarettes a day for the last 40 years.
- *Which of these facts about Ms. Simpson might increase her risk of having a heart attack?*
- *What factors might contribute to Ms. Simpson's hypertension and obesity?*

Medical Ethics Case Study – Patient History

- The physician continues with Ms. Simpson’s history and asks about her **health-related behaviors** and **social history**:
 - Ms. Simpson has been on disability for the last six months after a hip injury
 - She lives in an apartment with her daughter, who is a single mother of a young boy and works full time
 - The Simpsons live in an area that does not have nearby supermarkets that supply fresh produce (this is known as a “food desert”)
 - There are no sidewalks or parks near the Simpsons’ apartment
 - Ms. Simpson feels that her neighborhood is generally safe during the day, but that she would not feel comfortable going outside at night
 - Ms. Simpson states that her family eats out often because of her daughter’s busy work schedule and the relatively cheap cost of fast food
 - Ms. Simpson understands the importance of exercise, but does not exercise regularly

Adapted from: Jue, JS. The Personal, Social, and Economic Determinants of Cardiovascular Disease. AMA Journal of Ethics 12, 812–817 (2010).

Medical Ethics Case Study – Patient History

- Good diet and regular exercise are two important factors that contribute to cardiovascular health
- *What is your evaluation of Ms. Simpson's diet and exercise routine?*
- *What social and environmental factors might influence what Ms. Simpson eats and how frequently she exercises?*

Medical Ethics Case Study – Social Determinants of Health

- The factors which influence an individual’s health beyond their genetic predisposition and personal choices can be thought of as “upstream factors” or “social determinants of health”
- The WHO defines social determinants of health as “the circumstances in which people are born, grow, live, work, and age, and the systems put in place to deal with illness”
- *What can Ms. Simpson’s physician do to help her manage her cardiovascular health once she recovers from her MI?*
- *What other individuals, organizations, or systems could have an effect on the upstream factors that contributed to Ms. Simpson’s MI?*

That's all for today!

- Enjoy your faculty lecture with Dr. Stephen Alerhand and his discussion of emergency medicine.
- Remember that next week is graduation! (No homeroom lecture; you'll have a presentation from the Admissions office instead, followed by a student panel).

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