FOOD NUTRITION LECTURE #2

Macro Nutrients (Proteins, Fats and Carbohydrates)

Recognize these values?

Nutrition Facts

Serving Size 2/3 cup (55g)
Servings Per Container About 8

Amount Per Serving

Calories 230	Calories from Fat 40
	% Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**12%**
Dietary Fiber 4g	**16%**
Sugars 1g	
Protein 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Nutrition Facts

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Calories **230**

% DV*	
12%	**Total Fat** 8g
5%	**Saturated Fat** 1g
	***Trans* Fat** 0g
0%	**Cholesterol** 0mg
7%	**Sodium** 160mg
12%	**Total Carbs** 37g
14%	**Dietary Fiber** 4g
	Sugars 1g
	Added Sugars 0g
	Protein 3g
10%	**Vitamin D** 2mcg
20%	**Calcium** 260mg
45%	**Iron** 8mg
5%	**Potassium** 235mg

* Footnote on Daily Values (DV) and calories reference to be inserted here.

First things first…What is a calorie?

Answer…

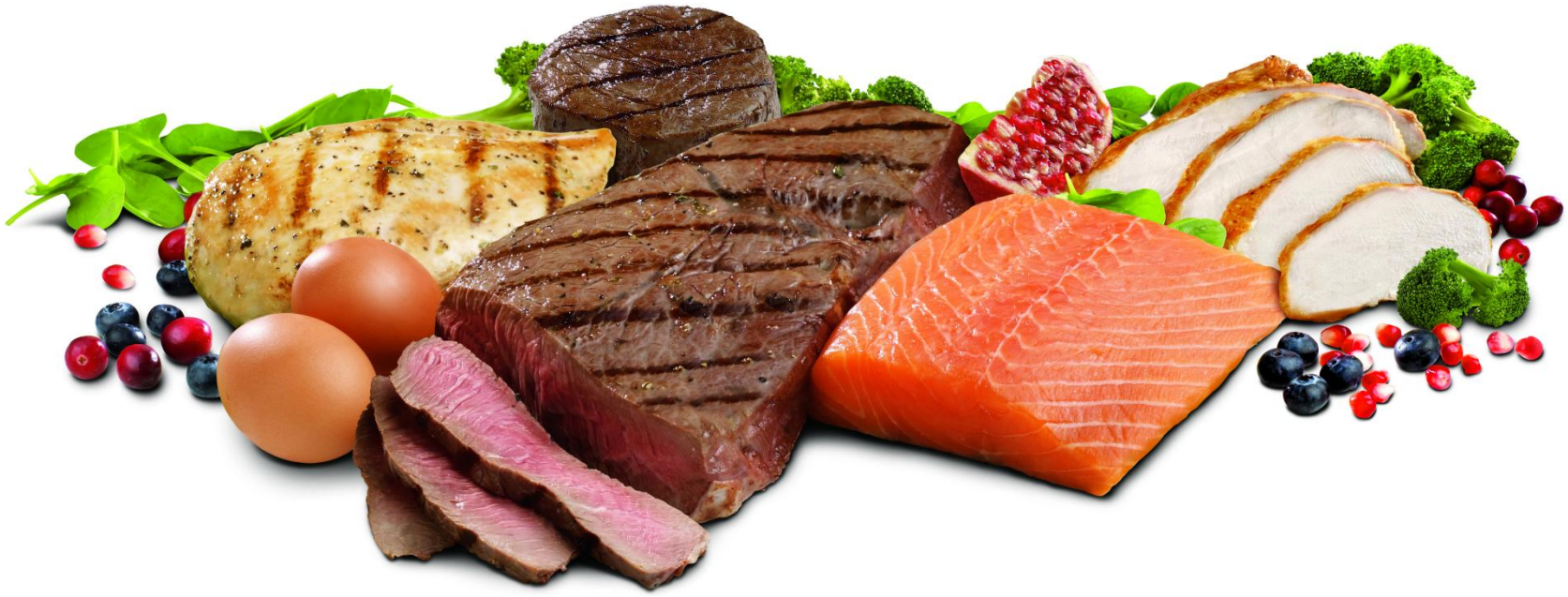
- As defined by MedicalNewsToday:

- "**A calorie is a unit of energy.** In nutrition and everyday language, calories refer to energy consumption through eating and drinking and energy usage through physical activity. For example, an apple may have 80 calories, while a 1 mile walk may use up about 100 calories."

- 1kCal is the amount of energy required to raise one kilogram of water by one degree Celsius.

PROTEIN AND AMINO ACIDS

Let’s start with Protein



Sources: Red Meat, Fish, Poultry, Eggs, bread, rice and pasta
To name a few.

What is Protein

- Protein provide the building blocks for all cells and for life itself.

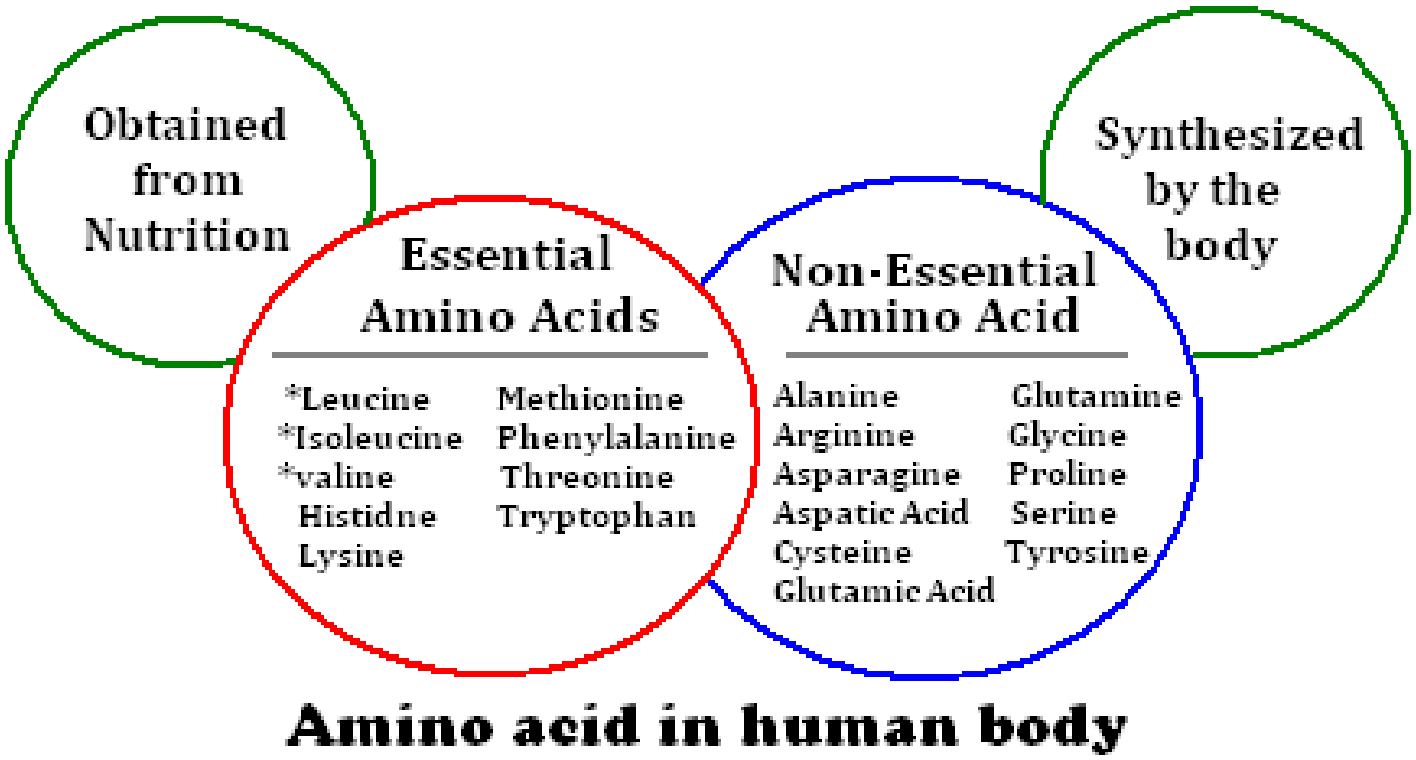
- They are made from 20 different amino acids, 9 of which are essential (you have to get them in your diet) while 11 are non-essential (your body makes them).

- When protein is broken down in the stomach (recall HCL), amino acids are released (since proteins are comprised of them). Proteins are also absorbed in the stomach via another mechanism.

What they Do

- Think of them as the bricks to making a house. They provide the structure for many different types of cells.
- Key component in repairing damaged tissue or strengthen existing tissue (i.e. keratin: strengthens protective coverings such as hair)
- Make hormones (i.e. insulin)
- Muscle contractions (actin and myosin)

Amino Acids



- **Note:** I do not expect you to memorize any of them. All you need to know is what proteins are made of and what essential and non-essential means.

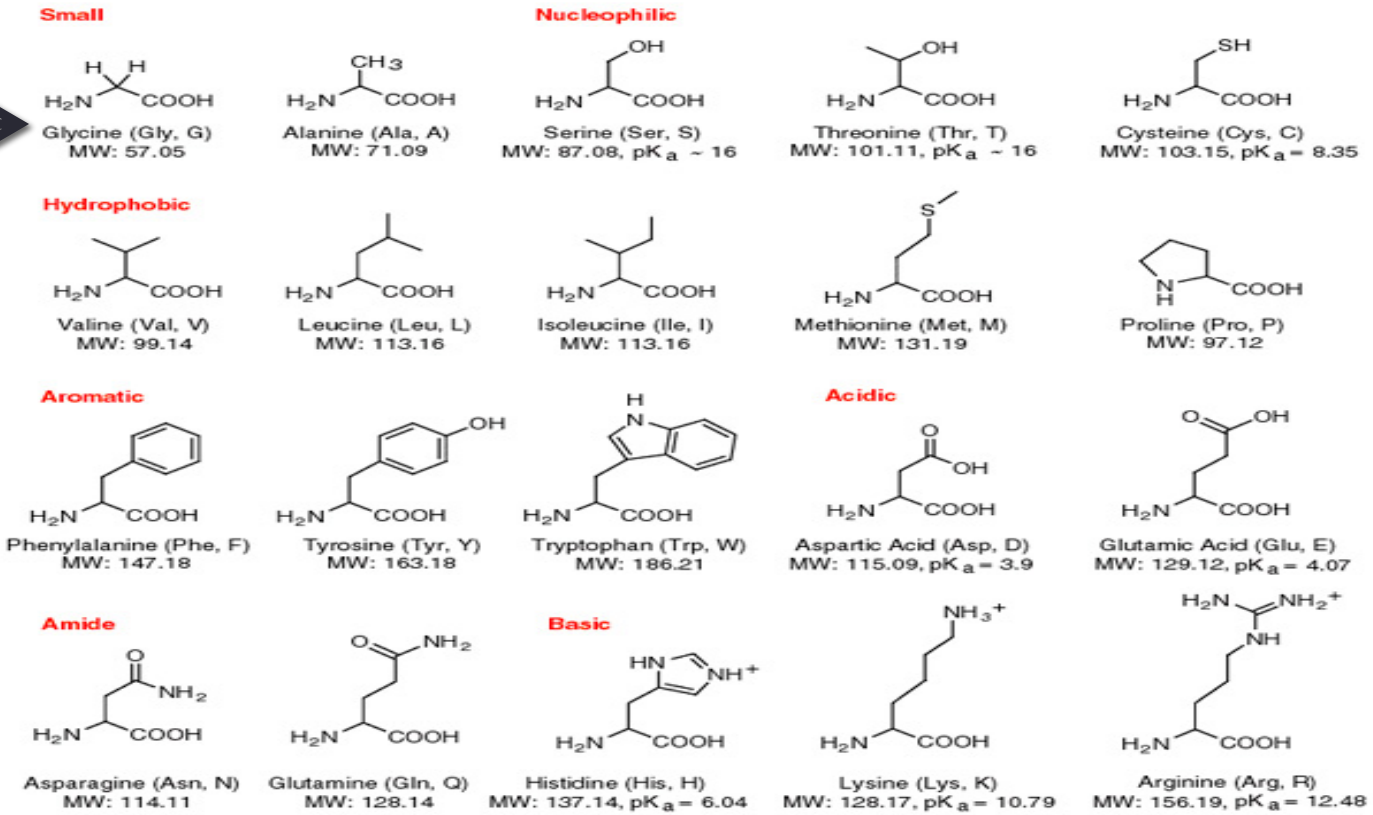
Protein Synthesis (aka Protein creation)

- The synthesis of protein is determined by genetic information
- This genetic information comes from DNA
- DNA provides the code and mRNA is the messenger molecule that brings this DNA to the nucleus (brain of the cell)
- The sequence of amino acids will determine its function.

Chemical Sequence

- The following picture depicts different sequences. Note: **Not tested**. Just see how different sequences enable different amino acids.

Name and Example of an amino acid



Breakdown and Turnover

- Protein is constantly being broken down and synthesized in the body (Protein turnover)
- If you are synthesizing more than you are excreting (via urine), than you have low turnover rate.
- If you are breaking down and excreting more than you are synthesizing, you will have a high turnover rate.

Daily Protein Intake

- Different individuals, depending on their activity level, weight and if they are healthy, will have different protein needs.

- On average, the recommended intake distribution is **10-35%** of your calories to come from protein.

- The recommended daily allowance (RDA) is **0.8g/kg/day** (regular people) and **1.2 – 1.7g/kg/day** (athletes, gym rats etc.)

Let's calculate

- So if you weight 150 lbs and you convert that to kg (150 divided by 2.2) you get 68 kg.

- If you are not a regular exerciser, you multiply 68 X 0.8g= 54g of protein per day.

- If you are working out in the gym, 1.2 – 1.7g/kg X 68 kg = 81.6g – 115.6 g of protein/day

Yo Bro, you take protein bro?

- You will come across Individuals who swear by Protein being the reason They are getting muscular “swole or jacked”.

- They believe that regardless of who you are, you should take at least 1g/lb of protein a day! So if you are 150 lbs, you should be at least taking 150 grams per day!

The fate of protein

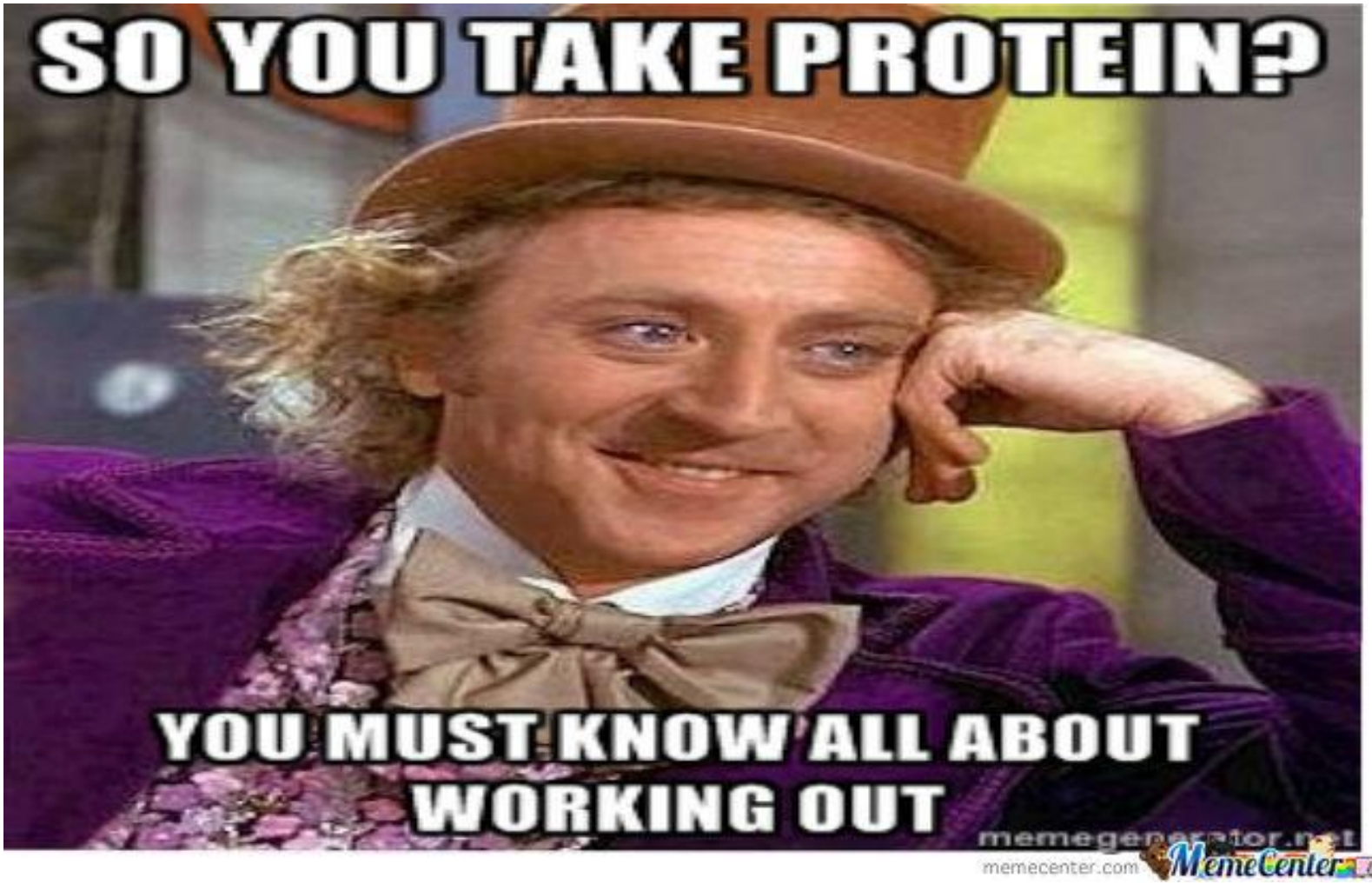
- Excess protein is not stored like carbohydrates or fats.
- Excess protein is used either for energy or it is excreted via the urine.
- So you can take go full out “broscience” with protein and take in far beyond the needs of your body, but your body will convert it to energy or excrete it. Therefore, no further benefits can be acquired.

Calories from Protein

- You get about 4 calories (kcals to be precise) from 1 gram of protein.

- So if you are eating 50 g of protein per day, you will be getting about 200 kcals from protein alone.

The Fate of Protein Sealed



FATS AND LIPIDS

Sources of Fats

- Primary sources of Fats include Margarine, olive oil, Grapeseed oil, Butter, Animal fats, Bacon, nuts and Many dairy products To name a few.

Nutrition Label

Note: Eating fats does not make you fat!

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The role and function of fats

- If protein are the bricks that make the structure of the cell, fats are the mortar that help connect the bricks together.

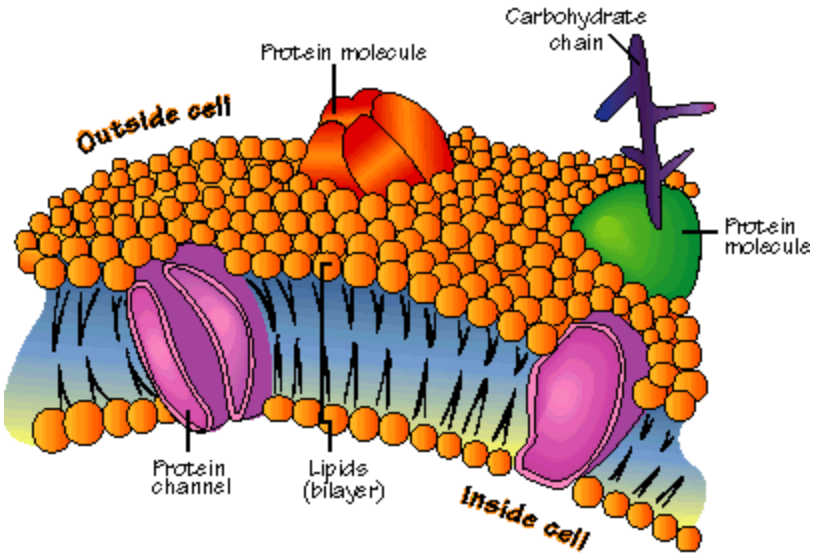
- Fats also act as another

Source of energy much like

Carbohydrates. (Proteins

Can be used as energy though

They are not as efficient)



- Provide insulation for our organs as well as our bodies as a whole unit.
- They also help create hormones like testosterone.

What are fats comprised of?

- Fats (Lipids) are comprised of fatty acids that come from three main forms of fats:

- Unsaturated:
1) Mono
2) Poly
- Saturated Fats
- Trans Fats

Healthy Fats	
Type of Fat	**Major Food Sources**
Monounsaturated Fat / Monounsaturates	Olive, canola and peanut oils, avocados, non-hydrogenated margarines, nuts and seeds
Polyunsaturated Fat / Polyunsaturates •Omega-6 Fat •Omega 3 Fat	 Safflower, sesame, sunflower and corn oils, non-hydrogenated margarines, nuts and seeds Fattier fish, canola and soybean oils, flax seed, omega-3 eggs, walnuts

Unhealthy Fats	
Type of Fat	**Major Food Sources**
Saturated Fat / Saturates	In many prepared foods made with hydrogenated oils, as well as fatty meats, full-fat dairy products, butter, lard, coconut oil, palm oil, palm kernel oil and cocoa butter
Trans Fats	In all foods made with shortening or partially hydrogenated vegetable oil, and many snack foods, fast foods and ready-prepared foods

Fat Breakdown and Structure

- All fats are broken down into fatty acids.

- The main structure of fats is called a **triglyceride.**
- A **triglyceride** is comprised of three fatty acids with a glycerol molecule attached. (Tri=three)

- Fatty acids form chains that are either short or long. Short chains have a lower melting point and longer chains have a higher melting point. (More on this in the next few slides)

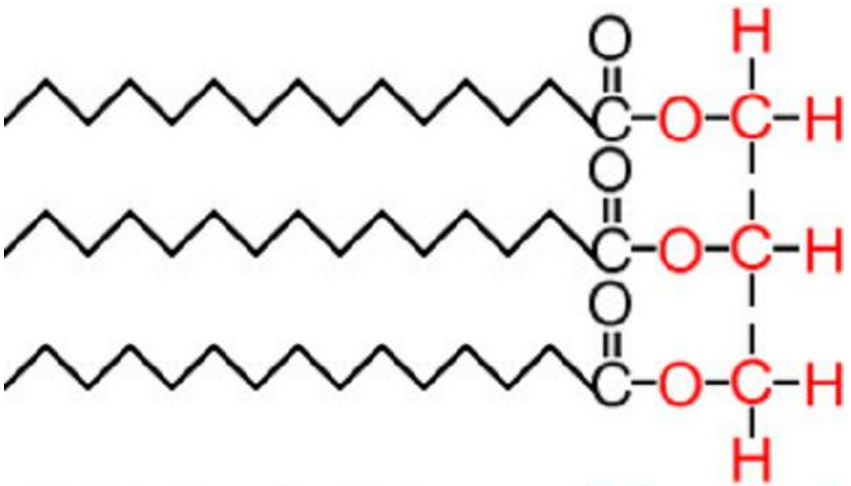
Fat Breakdown and Structure

- Saturated fats tend to

Have shorter chains

Whereas unsaturated

Fats have longer chains.



Triglyceride compound

- If you want to make

Something more solid at

Room temperature, **hydrogenation** (adding a hydrogen to a fatty acid) will do the trick. Saturated fats are better for cooking because they do not break as easily.

Level of saturation

- You hear terms like saturated and unsaturated fats but what do they mean?

- Saturation refers to how many hydrogen atoms surround each of the fatty acids. The more saturated a triglyceride is, the more solid it is at room temperature. The opposite remains true.

Cholesterol

- Is a combination of a lipid and protein. Thus it belongs to the lipoprotein family.
- Its role is to act as a component to make hormones, but it also allows the surface of a cell (cell membrane) to be more stable and secure.
- Two types of cholesterol in general:
- LDL: Low-density lipoproteins “bad cholesterol”
- HDL: High-density lipoproteins “good cholesterol”

Examples of LDL and HDL cholesterol

LDL Source

LDL: Think fast food, fatty meats and butter.

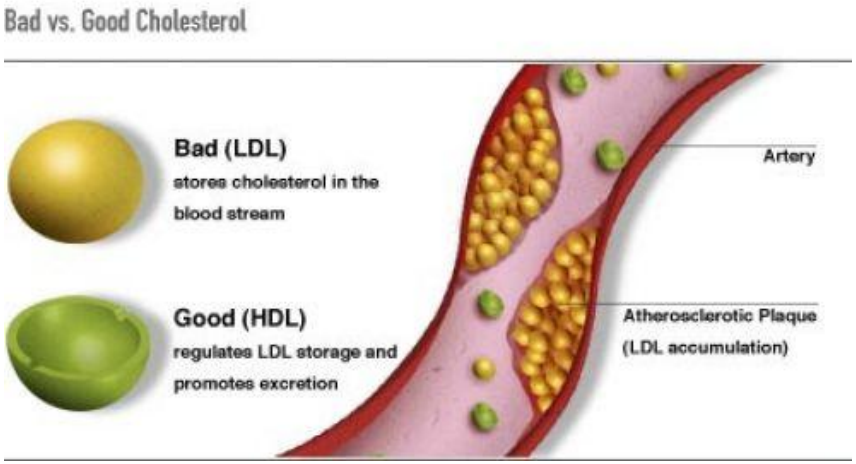
HDL Source

HDL: High quality fish like salmon, avocado and even whole eggs.

Why HDL is important

- HDL cholesterol acts as a janitor in your arteries. Their higher density is a result of having more proteins than fats.

- The HDL picks up the excess cholesterol “usually LDLs” and transports it out of the blood stream.



Essential fatty acids

- If you recall, in the world of nutrition, the term essential means something that your body doesn't make, therefore you need to intake it in your diet.

- Two types of EFAs:

1) Omega 3
2) Omega 6

- In the North American diet, we have way more Omega 6s than 3s. The cheapest source of omega 3s are canned tuna.

What EFAs do

- EFAs are important in cognitive development (brain development in general)
- Low levels of them have been linked to mood swings, memory loss, hair and skin problems.
- Have a good ratio of omega 3s to 6s as well as consuming a good amount, will also benefit your cardiovascular health (blood pressure, heart rate etc.)

Calories from Fat

- **For 1 gram of fat, you get 9 kcals from it**.
- The reason being is that fat is more dense than carbohydrates thought its structure is not as dense as protein (amino acids are more dense than fatty acid chains).
- What makes it higher in kcals is due to being an energy source is that it’s more efficient than protein when its broke down. Carbs are broke down the quickest but they are not as dense.

The fate of Fats

- Excess calories from fat (and also carbs) is stored as excess body fat.
- Again, if you are eating a high fat diet, but you are within the maintenance of your caloric intake (not gaining or losing weight), you won't have an increase in fatty tissue.
- Theoretically, fat stored as excess tissue acts as an energy reservoir to tap into. (Obese people will survive a famine much longer than a fit and healthy individual).

Recommended Intake

- **The acceptable macronutrient intake for fats falls into a range from 20 – 35% from your total caloric intake.**

- If you are 150 lbs (68 kg) and fat is 9kcals per 1 gram of fat, and your total intake is 2000 kcals, your intake should range from 400 kcals – 700 kcals.

- To convert those values into grams, divide 400 – 700 from 9 kcals and you get = 44g – 77g.

Fat Summary

- Fat is essential to many body functions:

- Cell membrane structure
- Nerve cell transmissions (think EFAs)
- Protection of internal organs
- Insulation to retain body heat

CARBOHYDRATES

May 14th, 2015

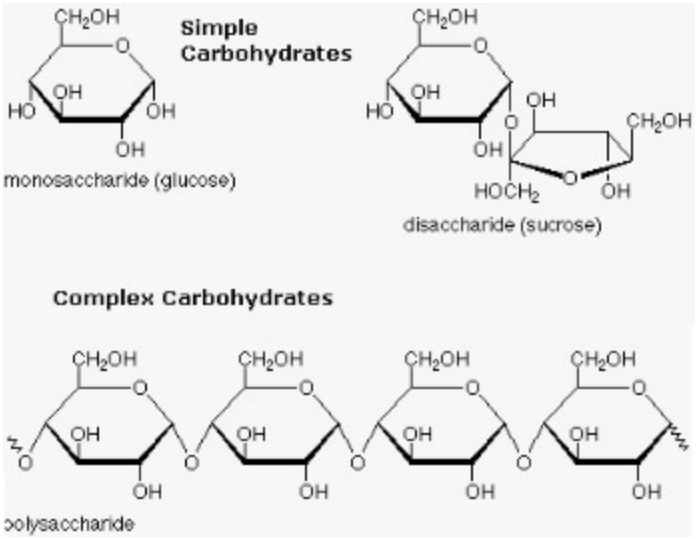
Before we begin…

- https://www.youtube.com/watch?v=dbvfGIieLZg

What are Carbohydrates?

What are Carbohydrates?

- Made up of groups of molecules, known as saccharides.
- These saccharides contain carbon, hydrogen and oxygen atoms in different sequences.
- Two main classes of carbs:
- 1) Simple (Mono and Di)
- 2) Complex (Poly)



What do they do?

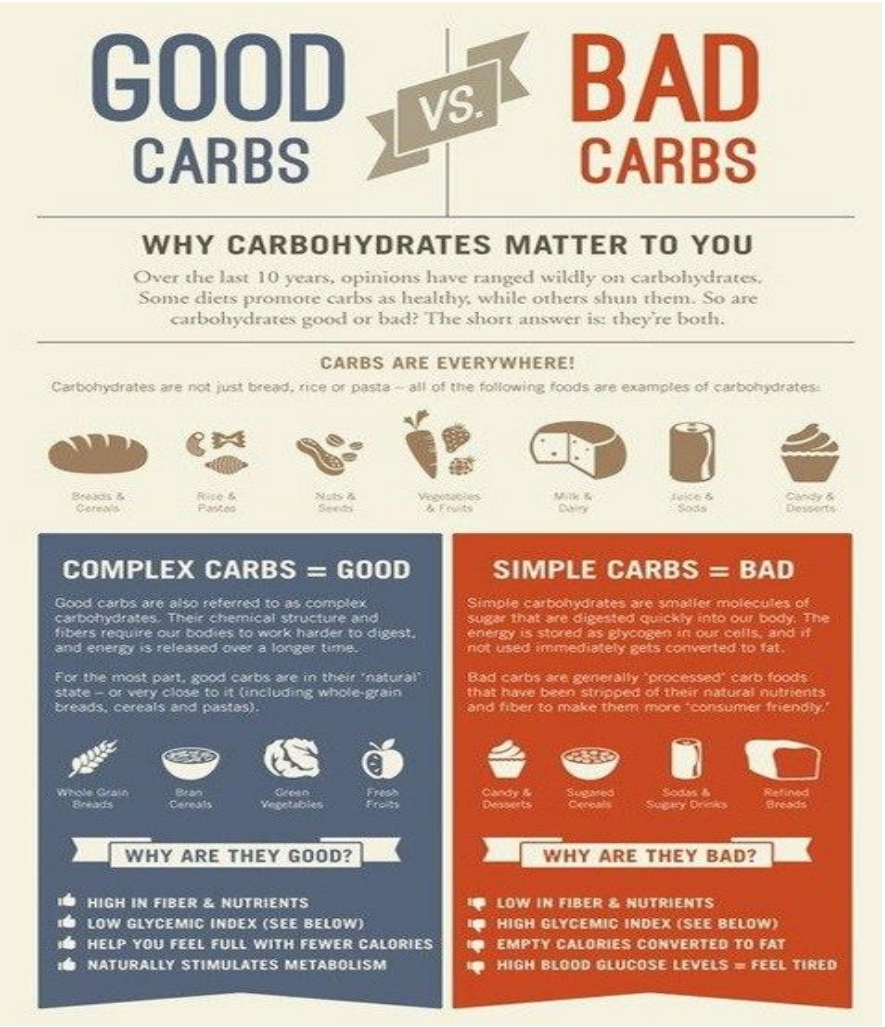
- Carbohydrates are a macronutrient, much like proteins and fats. However, they are used a little bit differently than the other two.

- **Carbs primary role is to provide energy for the body.** Fats do this as well however fat breakdown takes longer than carbs breakdown due to their density and greater complexity.

Sources of Carbs

Grains & Tubers	Legumes	Fruits	Vegetables	Other
Oats	Kidney Beans	Apple	Brocolli	Soda
Barley	Lima Beans	Orange	Spinach	Fruit Juice
Brown Rice	Black Beans	Banana	Kale	Candy
Sweet Potatoes	Chickpeas	Pear	Cauliflower	Pastries
Yams	Green Beans	Grapefruit	Asparagus	Cookies

Simple vs. Complex



Sources of simple carbohydrates (sugars)	Sources of complex carbohydrates (starches)
Sucrose (sugar)	Pasta
Honey	Rice
Syrup	Bread
Boiled sweets	Potatoes
Wine gums	Noodles
Non-diet sweet beverages	Cereals

Carbs Breakdown

- All carbs, regardless of whether they are complex or simple, are broken down into glucose.

- Glucose is the primary fuel for the body.

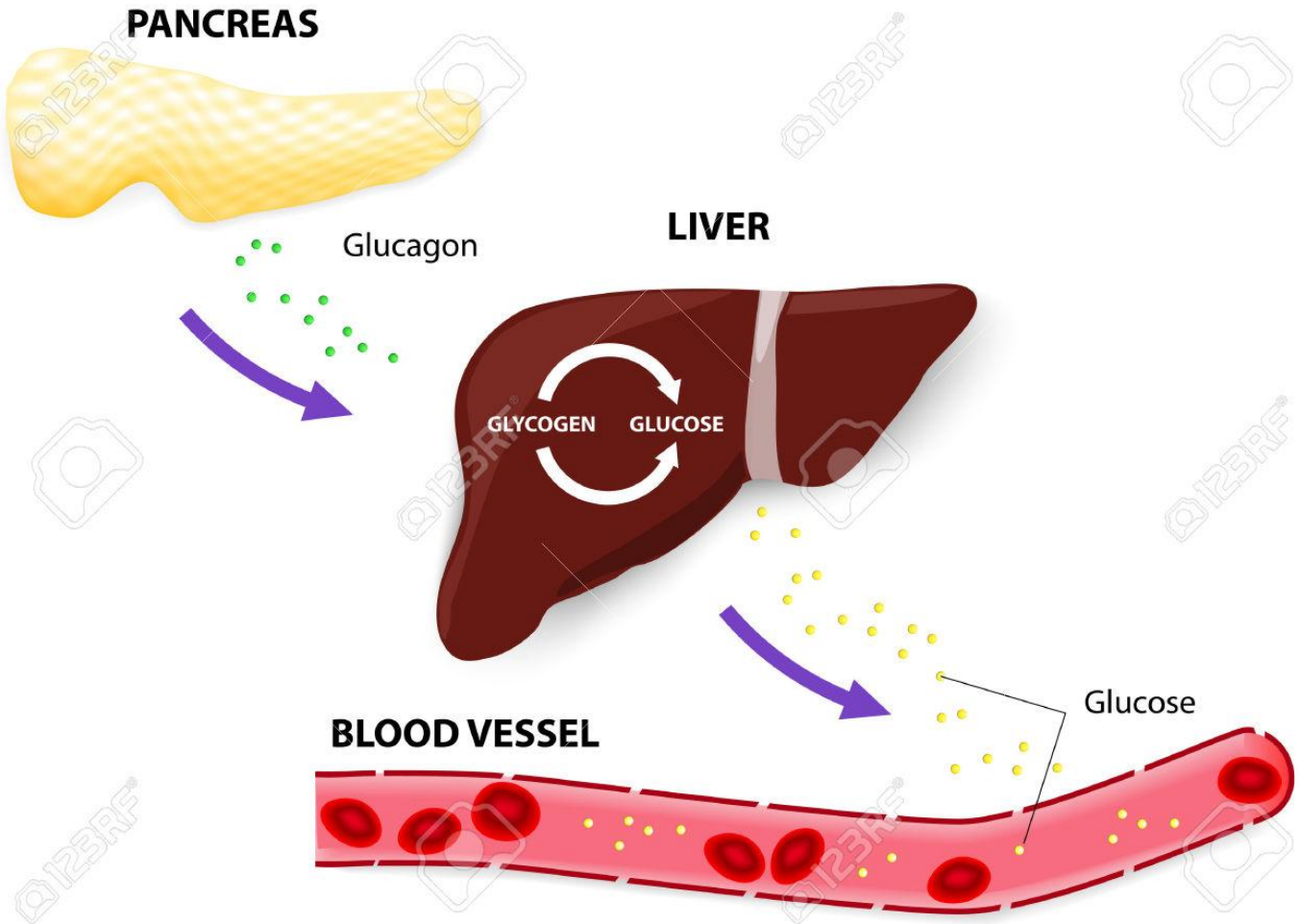
- Glucose is one of the most important molecules in the body for one reason: **The ultimate purpose of our body is to maintain blood glucose levels in the brain. The brain exclusively uses glucose to fuel itself.**

Glucose Investigated

- All sugars, whether its lactose from milk, fructose from fruits, galactose (combination of glucose and lactose), and sucrose (artificial sweetener), are all converted into **glucose** for the body's energy metabolism.

- Once your body has used the necessary glucose for any given activity or activities, it is stored in the liver as **glycogen**. When you need it again, glycogen is converted back to glucose.

Glycogen and Glucose



Note:
Glucagon is a molecule that raises blood sugar. It acts on the liver to convert glycogen to glucose.

Recall Digestion

- Starches are broken down and absorbed in the mouth with the enzyme called salivary amylase. (Released from saliva).

- All other carbs are broken down from poly (many) and disaccharides (two) and into monosaccharides (mono=one)

- Once everything is mono, they are absorbed in the small intestine where they travel to the liver and are converted to glucose. Again, extra glucose becomes glycogen.

The Final Fate of Carbs

- If you have plenty of blood glucose and your glycogen is at full capacity, the remaining glucose is then converted into triglycerides (fatty acids) and then stored in fatty tissue.

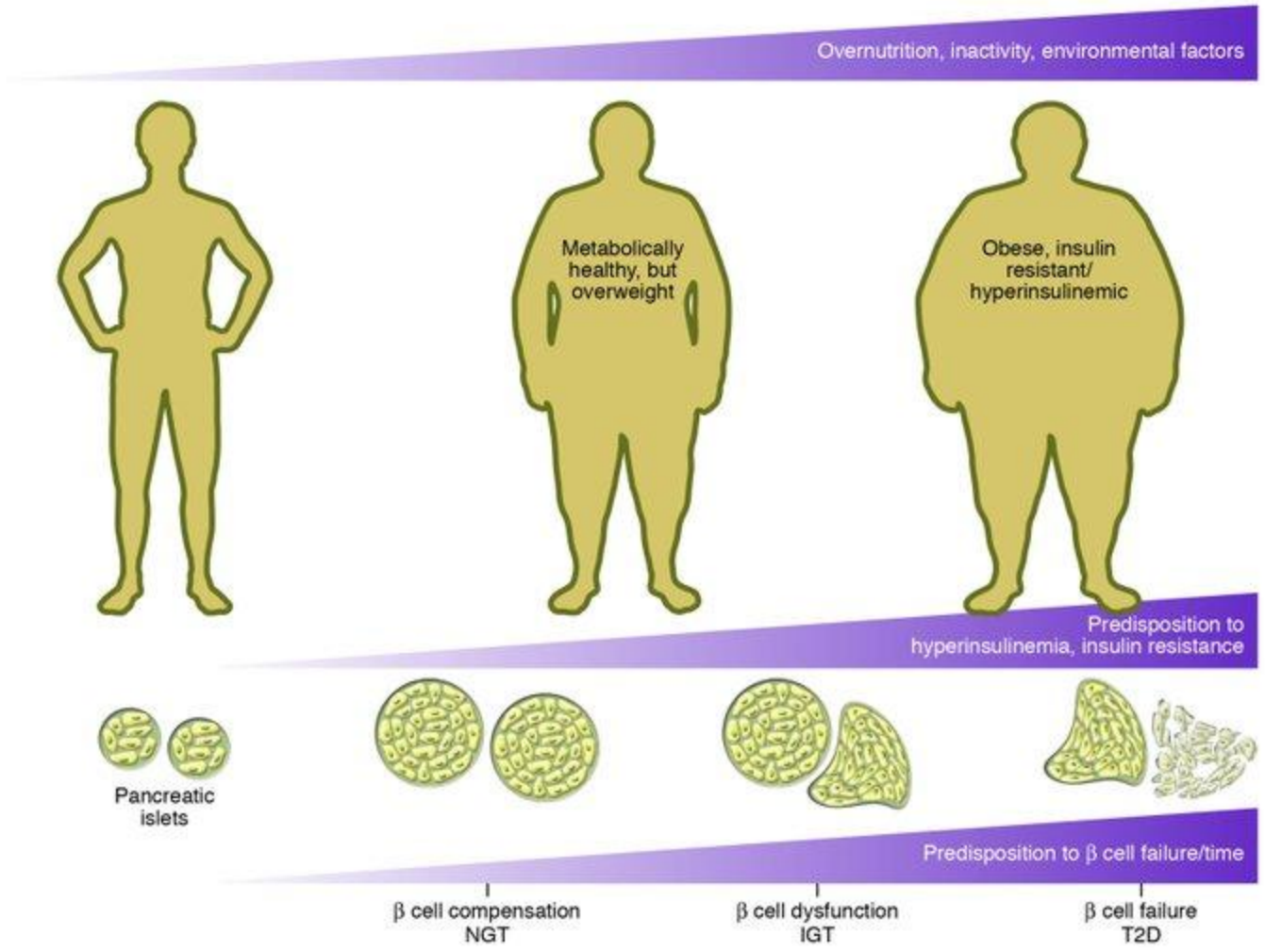
- What this means is if you are eating way too much candy and/or simple sugars or complex carbs, and if your calories are above maintenance, you will deposit fatty tissue across your body (carbs are not excreted like excess proteins).

Has anyone ever heard of Diabetes? If so, can you describe it?

From this…


Your goal is to maintain normal blood glucose levels
Glucose in blood
Excessive blood glucose
A.D.A.M.

To this…Type 2 Diabetes



Macronutrient order of operations

- So the body can get energy from fats, proteins and carbs. Which one does it prefer in order from high intensity exercise to low intensity exercise or sedentary behavior?
- Note: **Sedentary= not being active**

Carbs	Proteins	Fats
High Intensity	Small contribution to energy	Low to moderate
Used all the time	Used all the time	Used all the Time

Order of Operations Summary

- Basically, when you are not doing much, your body will primarily use fats for fuel. However, even at high intensity, your body will still use fats.

- At low intensity, energy from carbs won't be used as much. At high intensity they are the primary energy source because carbs as a molecule are more efficient due to their simpler nature and lower density. (Fats are more dense and more complex)

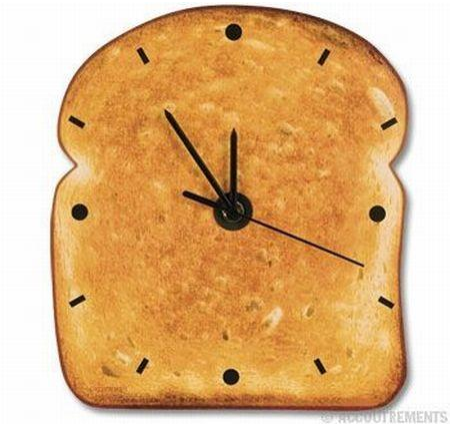
- Protein for energy is not really used because their purpose is more for the structure and building/repairing of cells and tissues. In extreme situations when you are energy depleted, protein will be broken down into glucose.

Macronutrient range for Carbs

- The recommended range for carb intake is **45-65%** of your total caloric intake.
- **1 gram of carbs = 4kcals or 4 calories.**
- So if you consume 2000 kcals and 55% of it is from carbs, the math then becomes: 0.55 X 2000 = 1100kcals from carbs.
- To convert to grams it becomes 1100 kcals divided by 4 = 275 grams of carbs.

Carb Timing and Carb Loading

- Carbohydrates can be used efficiently to help maintain weight or help improve muscle growth.
- Carbs are especially important for strength athletes and athletes that partake in endurance events.
- Timing carbs refers to having carbs at specific times throughout the day, especially in regards to the moments you engage in physical activity.

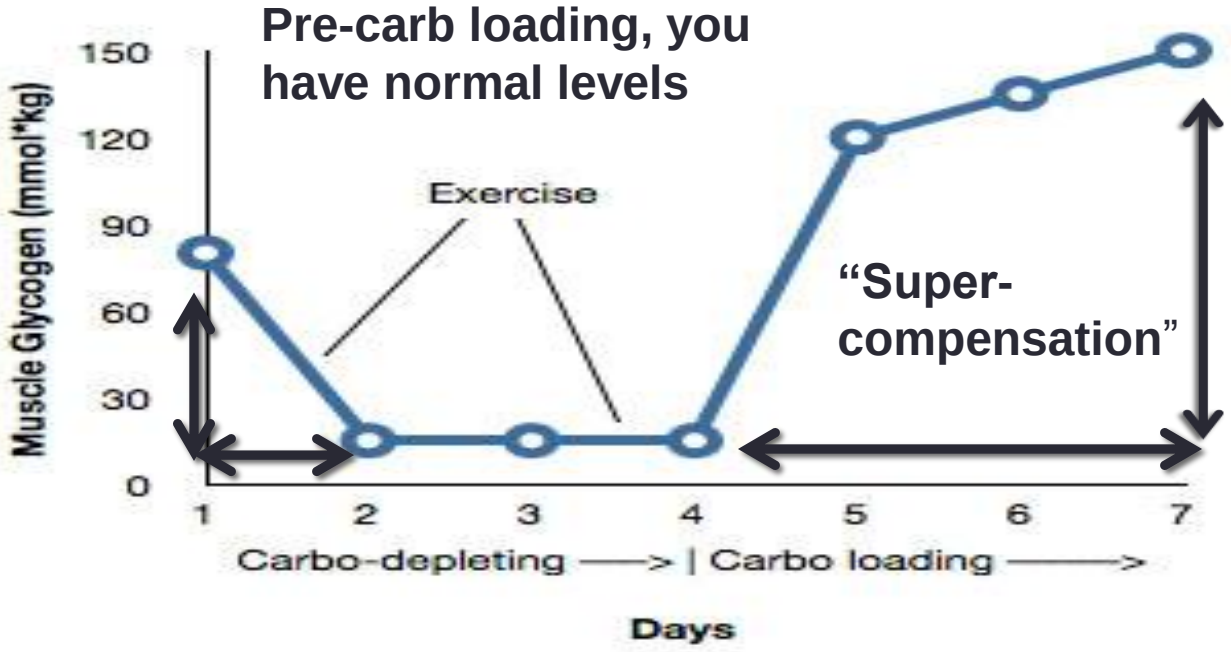


Carb Timing and Carb Loading

- Carb Timing distribution:
- 1) Morning: After a 6-8 hour sleep where you are technically on a fast, your carbs are depleted. Intake **moderate to high carbs** to replenish and fuel yourself for the rest of the day.
- 2) Post-workout: **Moderate to high** intake to again replenish your carbs after you used them for your workout.
- 3) Bed-time: **Keep your carb intake low**. Your metabolism has slowed down due to your body preparing itself for sleep.

Carb Loading

- Carb Loading is the act of depleting yourself of carbs 7-10 days from an event and then **3-4 days** from an event, you consume huge amounts of carbs to ensure you have more than enough carbs/glycogen to give you an advantage in your endurance event.



Super-compensation can only occur if you deplete. If you carb load without depleting, you will maintain normal levels of glycogen/carbs.

What is Type 2 Diabetes?

- **Type 2 Diabetes** is a chronic disease that occurs because of consistent elevated blood glucose, as well as overconsumption of carbs while maintaining a non-active lifestyle.

- The pancreas releases a hormone called **insulin. Insulin** responds by **lowering blood sugar** by attaching to cells that open channels for blood glucose to go into cells.

- Physical activity makes the muscles more active, thereby demanding more glucose to enter their cells. This helps to keep blood sugar at normal levels

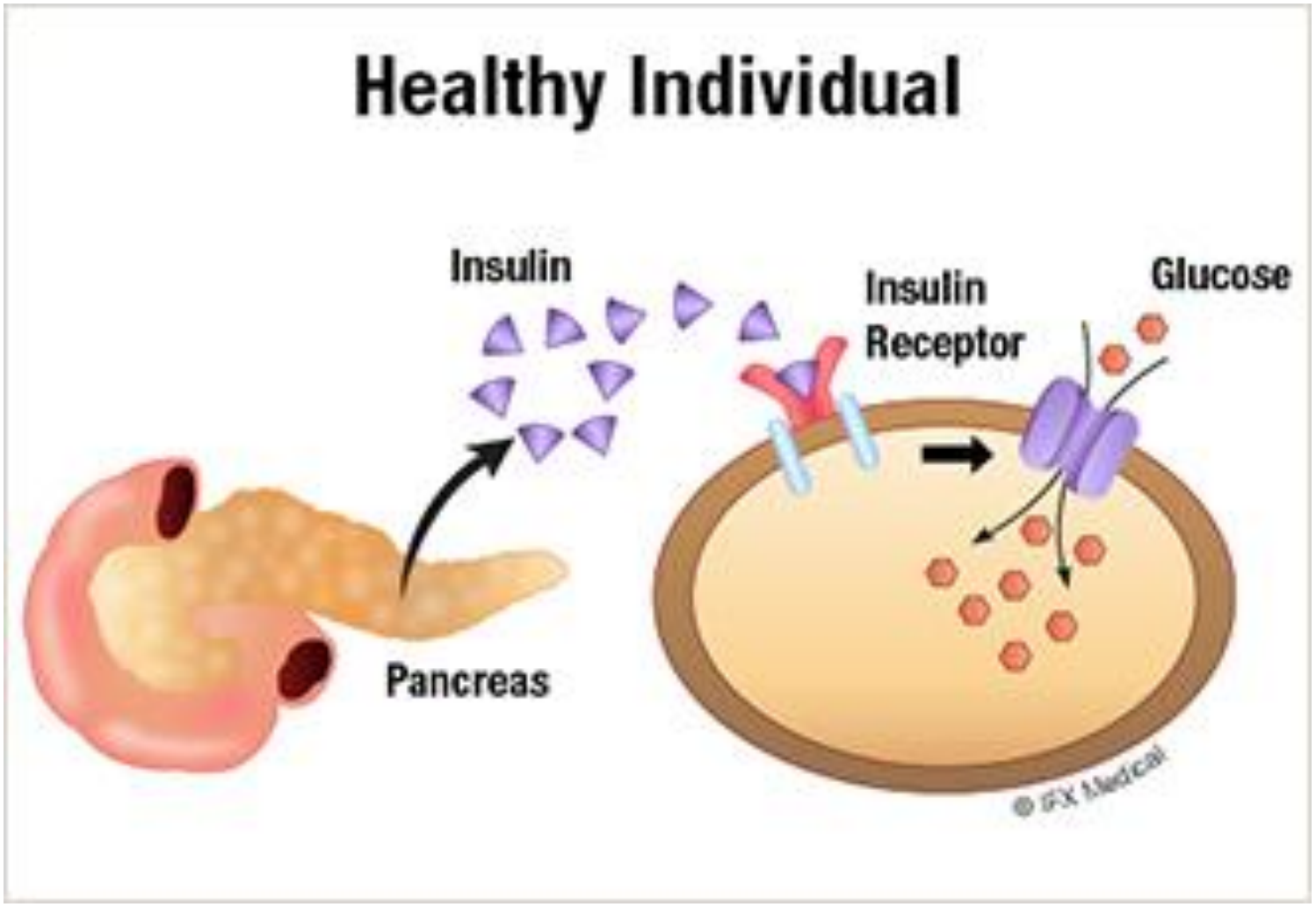
Why Type 2 Diabetes is a big problem

- Type 2 Diabetics are often obese or at the very least, overweight.

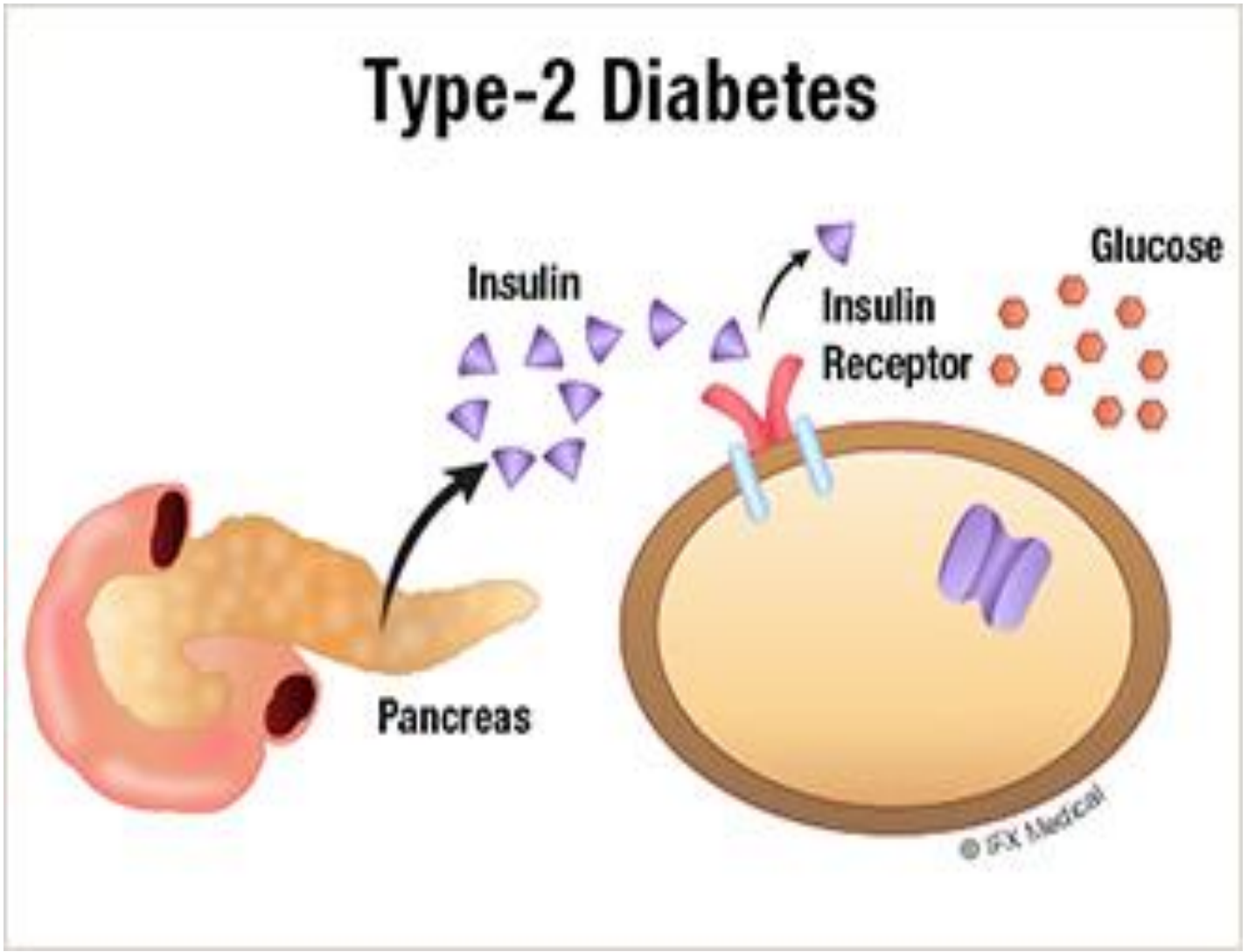
- The excess glucose circulating throughout your body can bind to different cells throughout the body, and disintegrate them. Glucose is stable when used for energy, unstable when it's bound to cells.

- This disease can lead to:
- -Blindness - Fatigue - Excessive urination
- **-Lower leg amputation** - Difficulty scabbing or healing
- -Temporary weight loss

Blood Glucose and Insulin



Blood Glucose and Insulin



Result of Diabetes

Infected toes. Lower limbs need to be amputated.

Right-eye blind