

CARBOHYDRATES

May 14th, 2015

PPL10

Before we begin...

- <https://www.youtube.com/watch?v=dbvfGlleLZg>

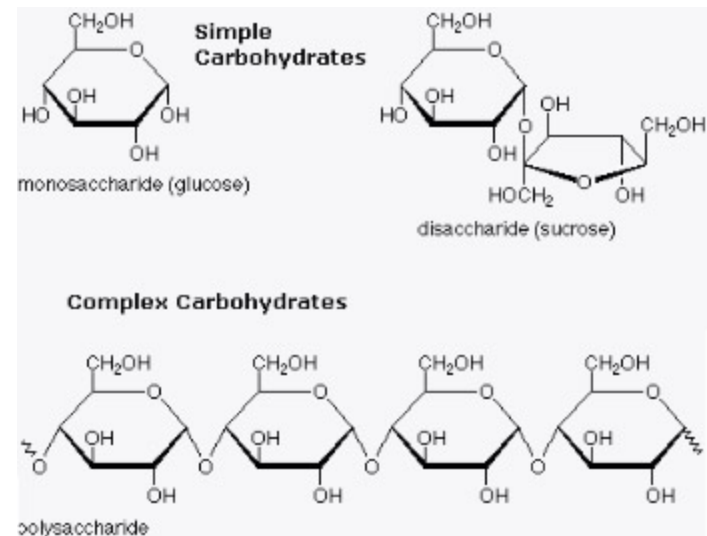
What are Carbohydrates?



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	Broccoli	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

**GOOD
CARBS**



**BAD
CARBS**

WHY CARBOHYDRATES MATTER TO YOU

Over the last 10 years, opinions have ranged wildly on carbohydrates. Some diets promote carbs as healthy, while others shun them. So are carbohydrates good or bad? The short answer is: they're both.

CARBS ARE EVERYWHERE!

Carbohydrates are not just bread, rice or pasta – all of the following foods are examples of carbohydrates:



COMPLEX CARBS = GOOD

Good carbs are also referred to as complex carbohydrates. Their chemical structure and fibers require our bodies to work harder to digest, and energy is released over a longer time.

For the most part, good carbs are in their "natural" state – or very close to it (including whole-grain breads, cereals and pastas).



WHY ARE THEY GOOD?

- 👍 HIGH IN FIBER & NUTRIENTS
- 👍 LOW GLYCEMIC INDEX (SEE BELOW)
- 👍 HELP YOU FEEL FULL WITH FEWER CALORIES
- 👍 NATURALLY STIMULATES METABOLISM

SIMPLE CARBS = BAD

Simple carbohydrates are smaller molecules of sugar that are digested quickly into our body. The energy is stored as glycogen in our cells, and if not used immediately gets converted to fat.

Bad carbs are generally "processed" carb foods that have been stripped of their natural nutrients and fiber to make them more "consumer friendly".



WHY ARE THEY BAD?

- 👎 LOW IN FIBER & NUTRIENTS
- 👎 HIGH GLYCEMIC INDEX (SEE BELOW)
- 👎 EMPTY CALORIES CONVERTED TO FAT
- 👎 HIGH BLOOD GLUCOSE LEVELS = FEEL TIRED

Sources of simple carbohydrates
(sugars)

Sources of complex carbohydrates
(starches)

Sucrose (sugar)

Honey

Syrup

Boiled sweets

Wine gums

Non-diet sweet beverages

Pasta

Rice

Bread

Potatoes

Noodles

Cereals

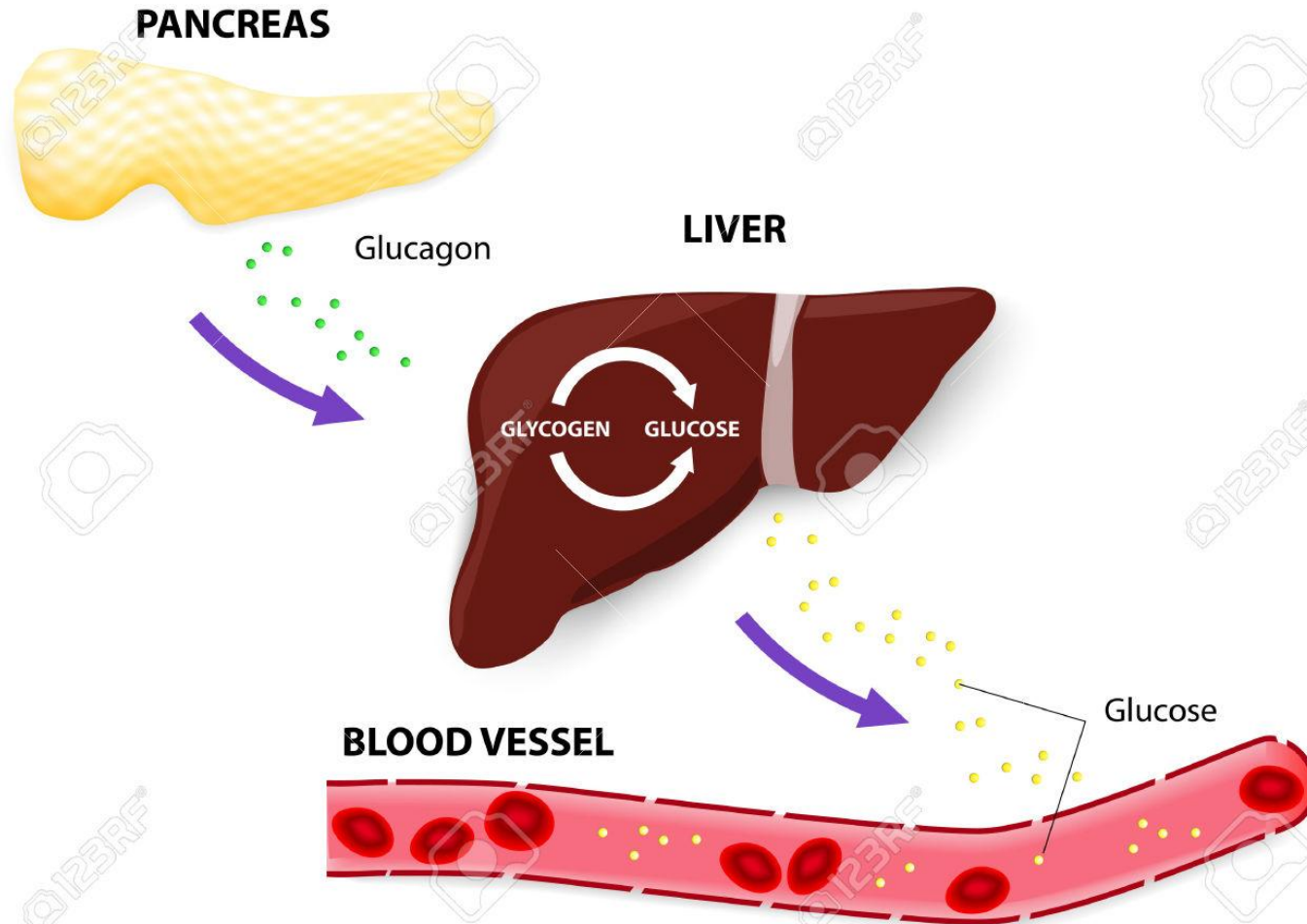
Carbs Breakdown

- 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

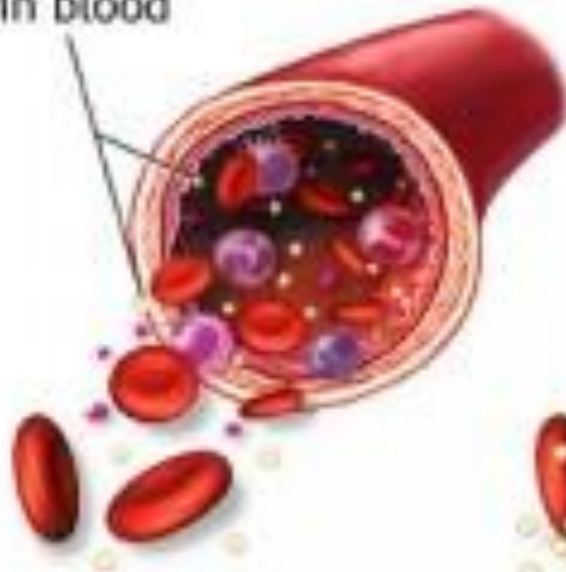
- If you have plenty of blood glucose and your glycogen is at full capacity, the remaining glucose is then converted into triglycerides (fatty acids) and then stored in fatty tissue.
- What this means is if you are eating way too much candy and/or simple sugars or complex carbs, and if your calories 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?

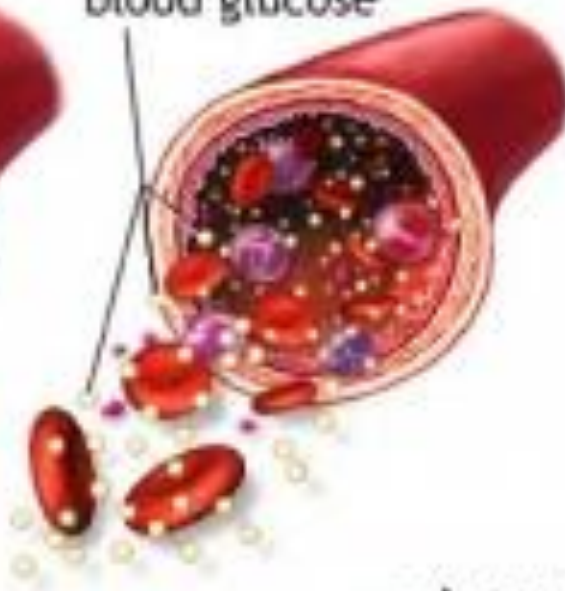
From this...

Your goal is to maintain normal blood glucose levels

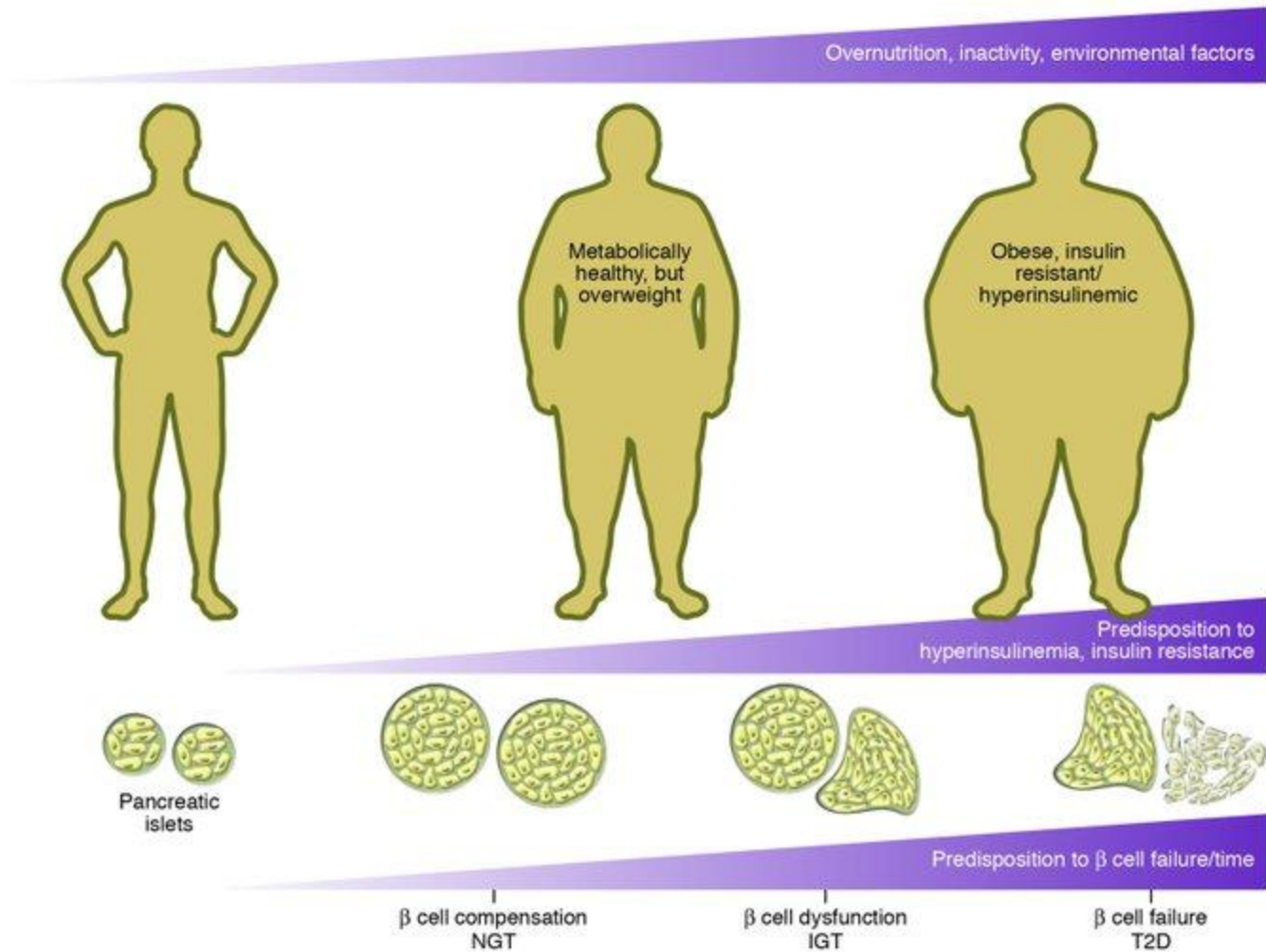
Glucose
in blood



Excessive
blood glucose



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**

<u>Carbs</u>	<u>Proteins</u>	<u>Fats</u>
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 = 4kcal or 4 calories.**
- So if you consume 2000 kcals and 55% of it is from carbs, the math then becomes: $0.55 \times 2000 = 1100$ kcals 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.

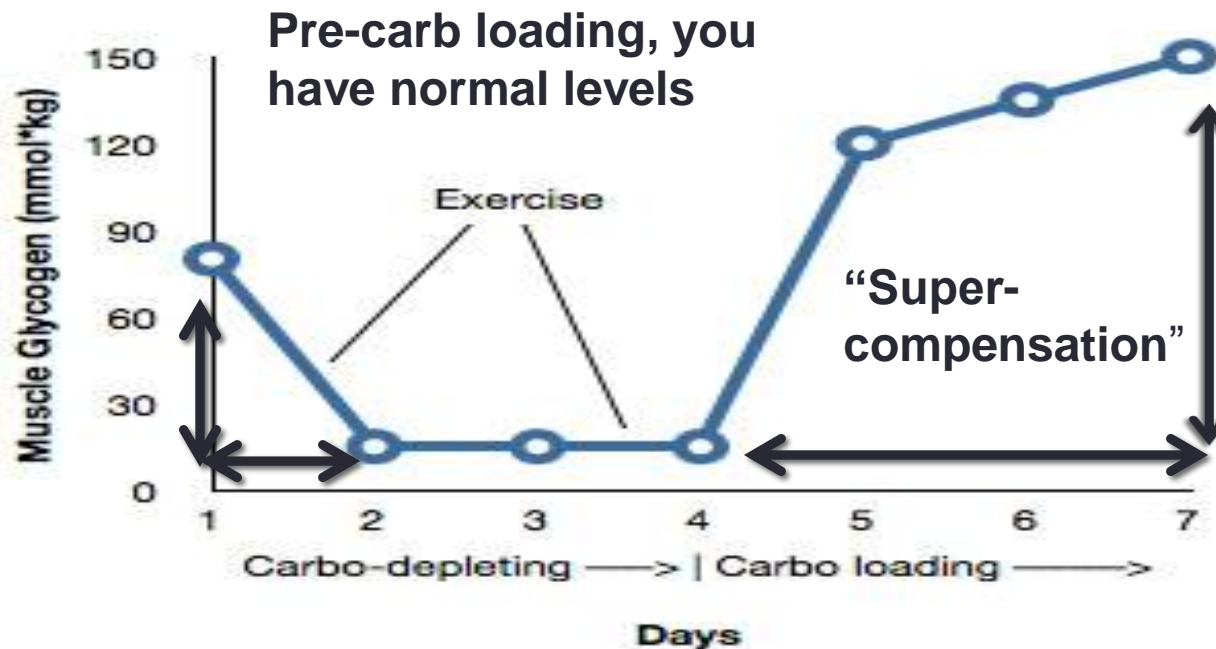


Carb Timing and Carb Loading

- 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.

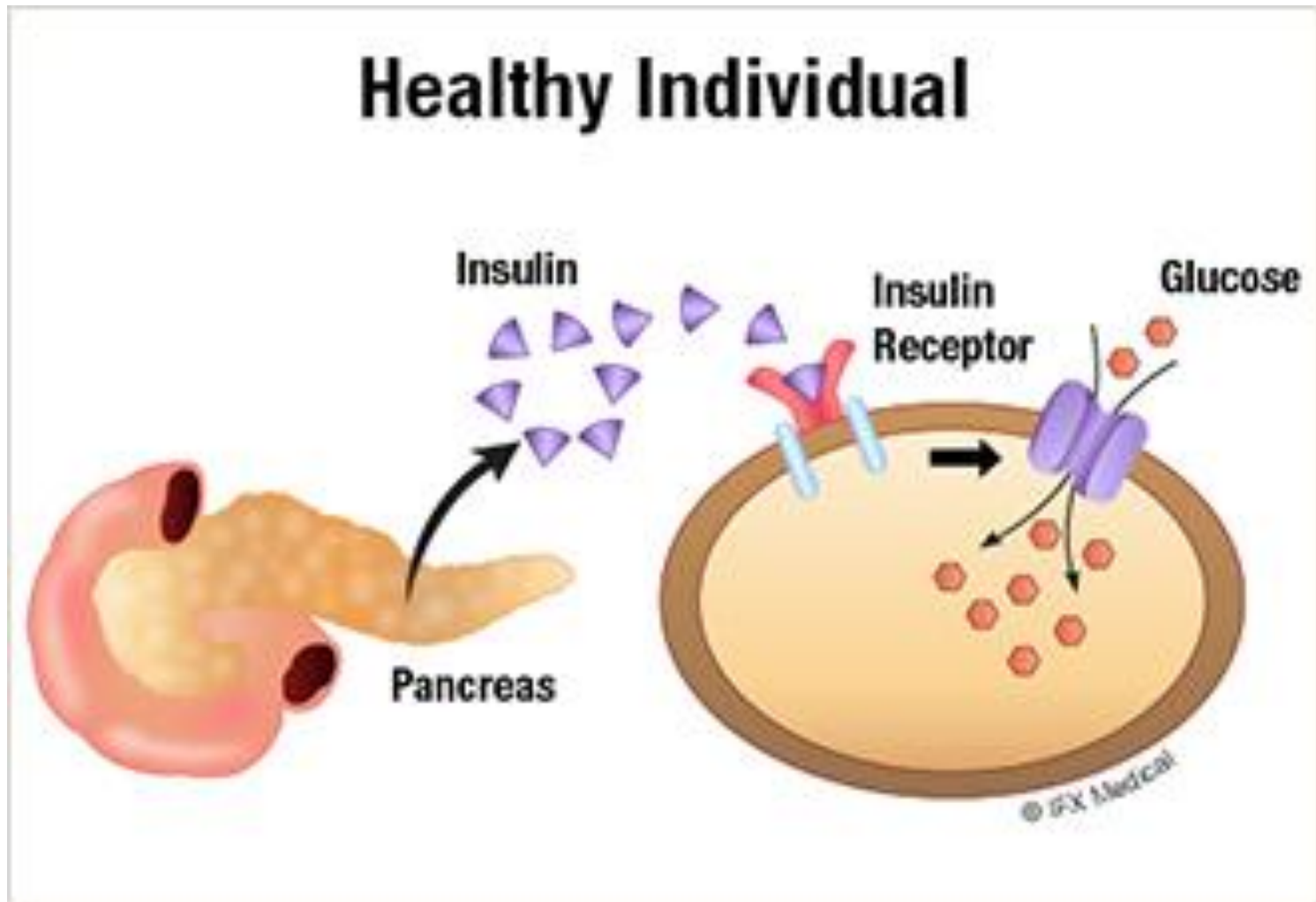
What is Type 2 Diabetes?

- **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

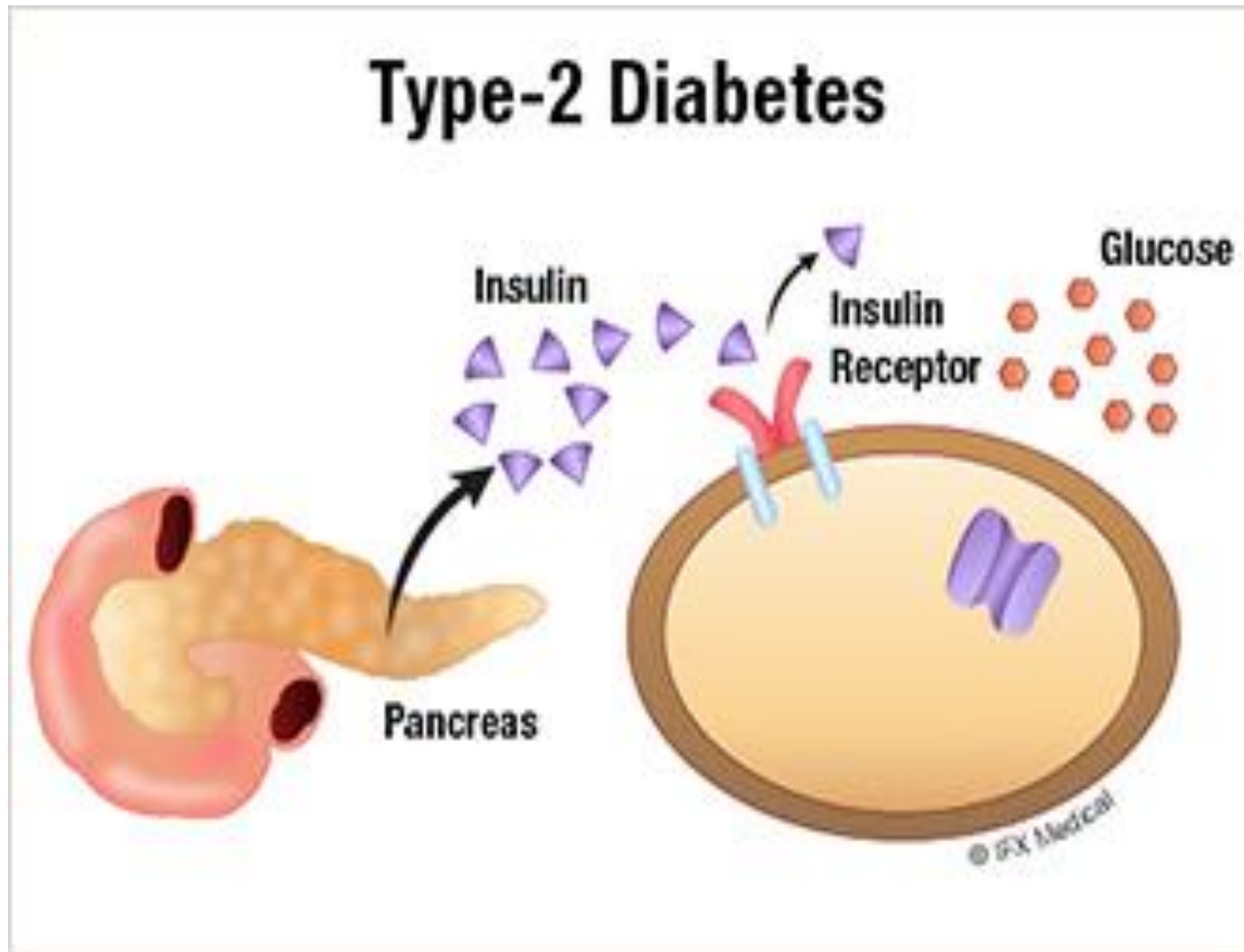
Why Type 2 Diabetes is a big problem

- 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