

The Basics of Insulin

UCSF Mini Medical School: Diabetes

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No disclosures

Insulin helps capture the energy that we get from carbohydrates

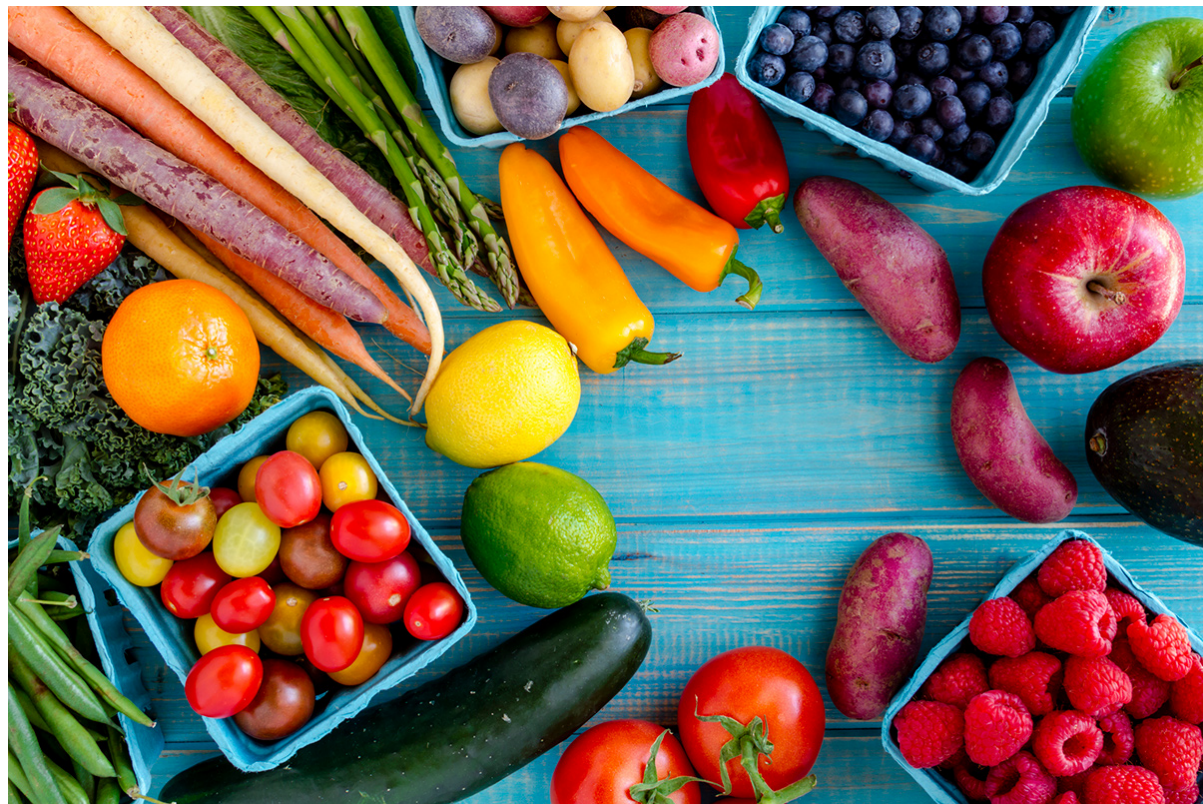


Image from heart.org



Image from health.harvard.edu

What happens to the carbohydrates we eat?

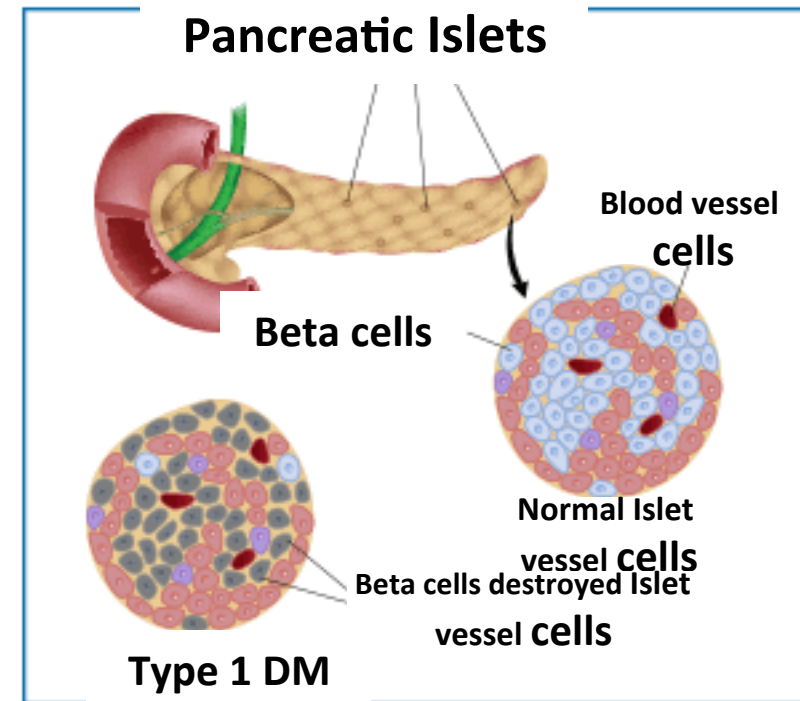
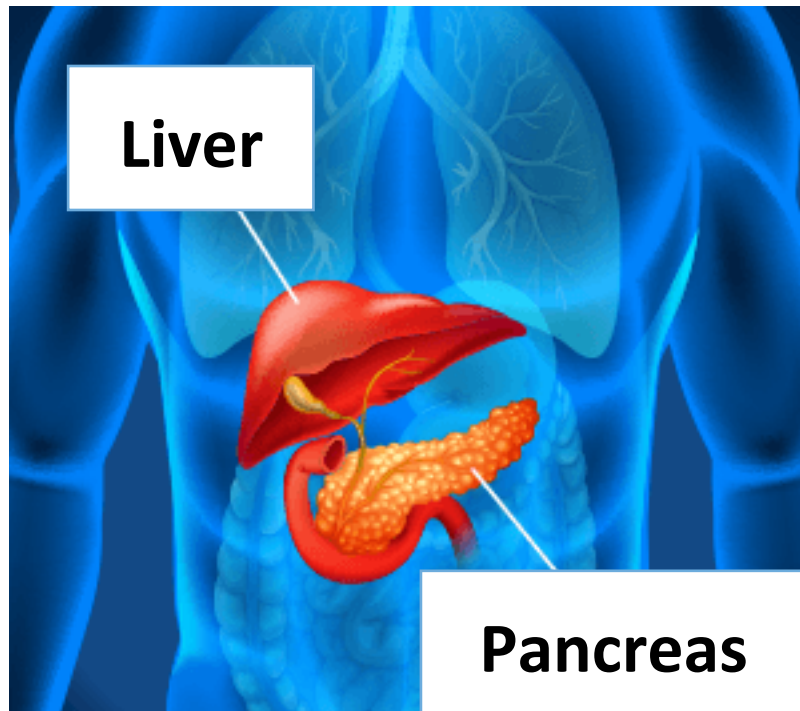
- Carbohydrates are digested by the intestines into sugars (e.g., glucose)
- Glucose is transported from intestines into circulation
- The pancreas senses a rise in blood glucose and **insulin** is released



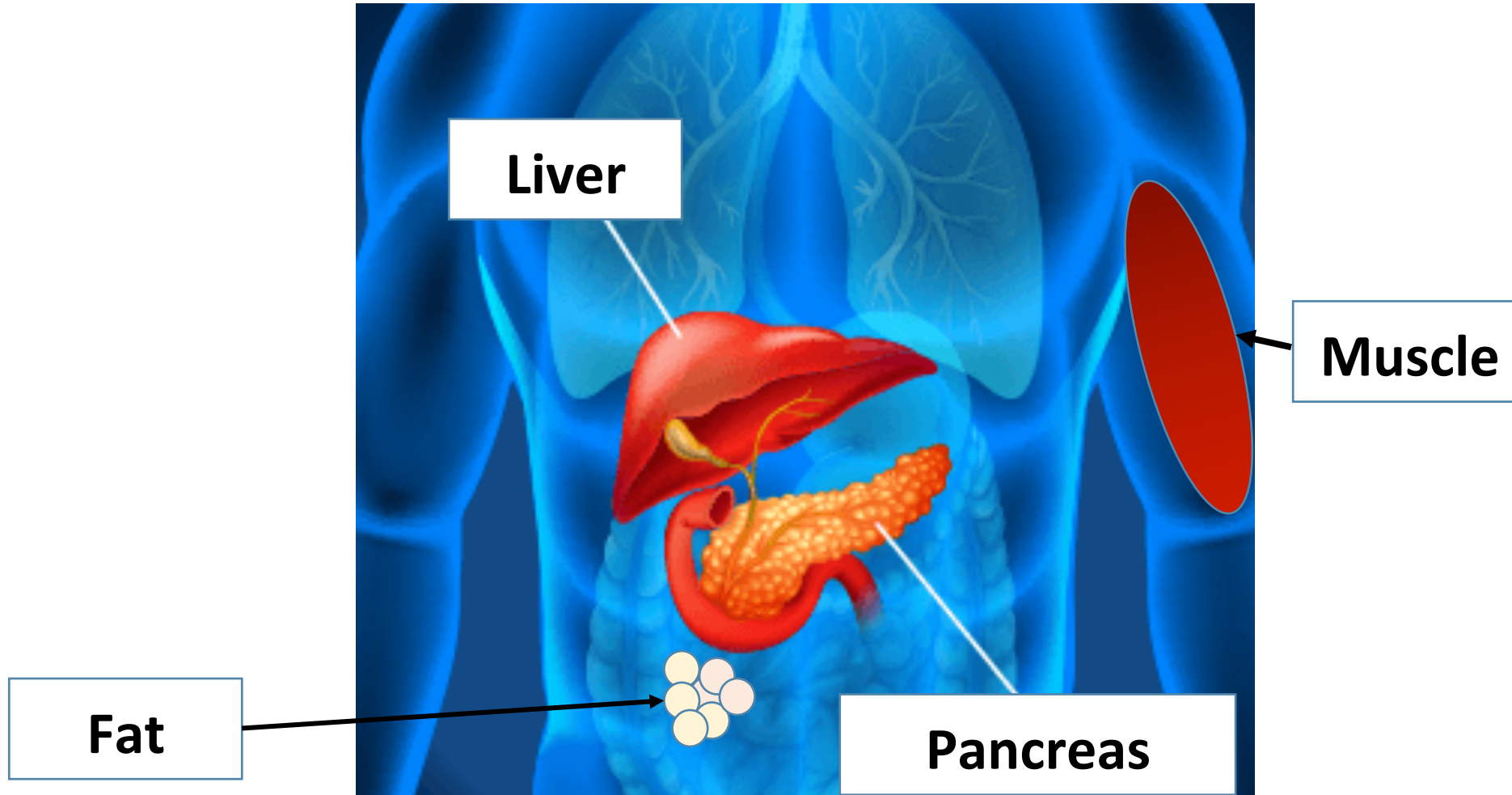
Image from <https://clinicalcenter.nih.gov/>

What is Insulin?

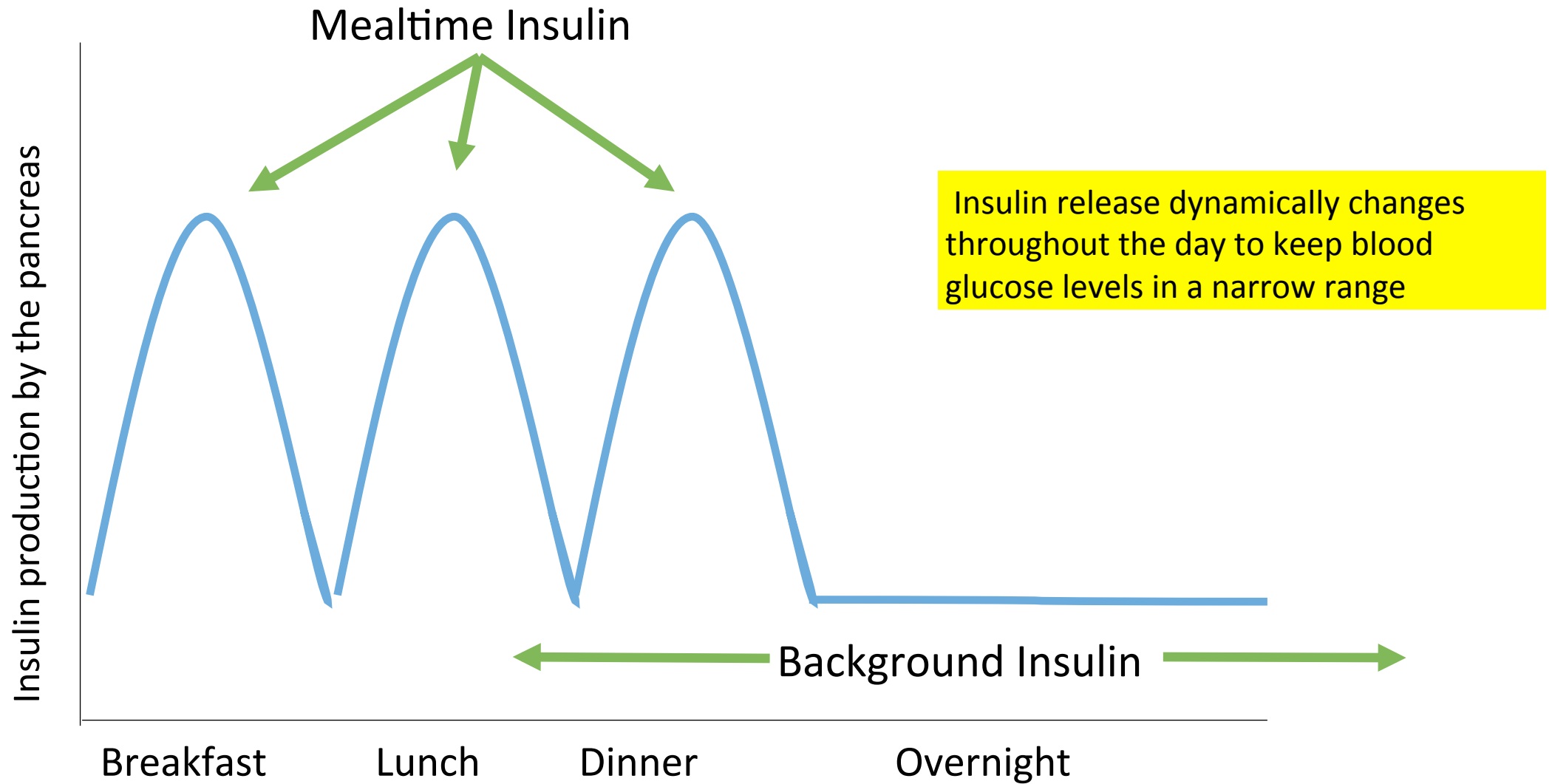
- Insulin is a **hormone** that is made by the pancreas
- A hormone is a chemical messenger



Insulin tells other organs to take in glucose from bloodstream



Insulin release from the pancreas



Diabetes results from insulin insufficiency

Type 1 Diabetes

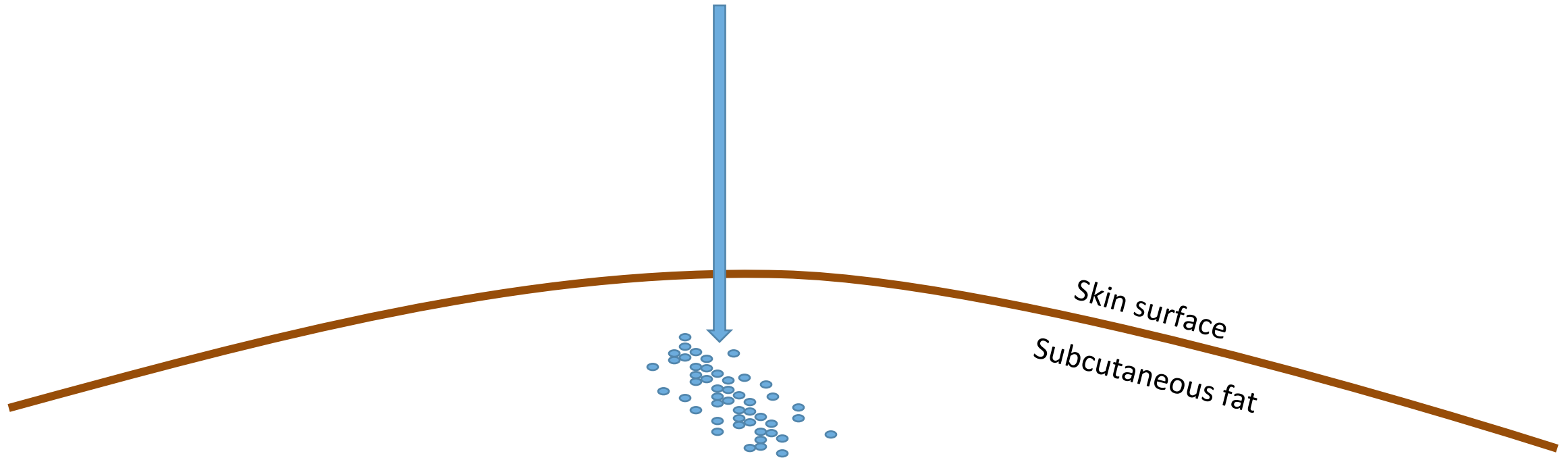
- Total or near total lack of insulin due to autoimmune attack of beta cells

Type 2 Diabetes

- Insulin resistance
- Varying degrees of insulin deficiency due to lack of enough functioning beta cells

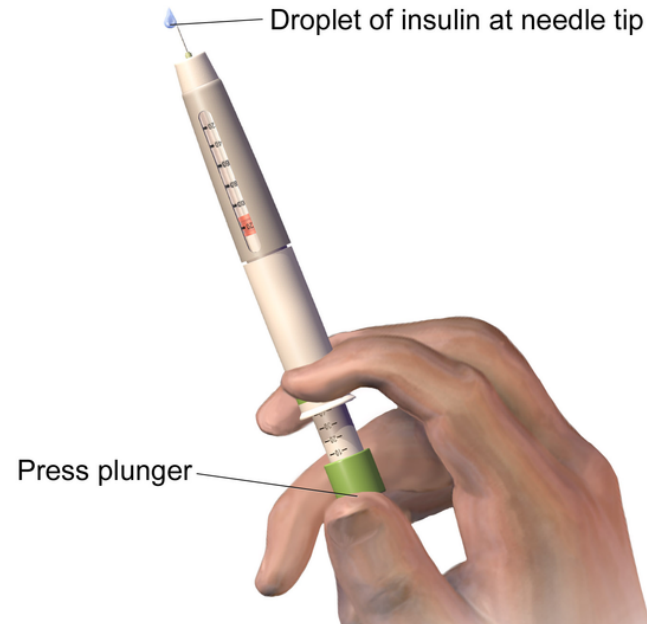
We can take “exogenous” insulin if we don’t make enough

Insulin is injected into the fatty space under the skin



Insulin molecules disassociate and enter the bloodstream

Different Ways of Injecting Insulin



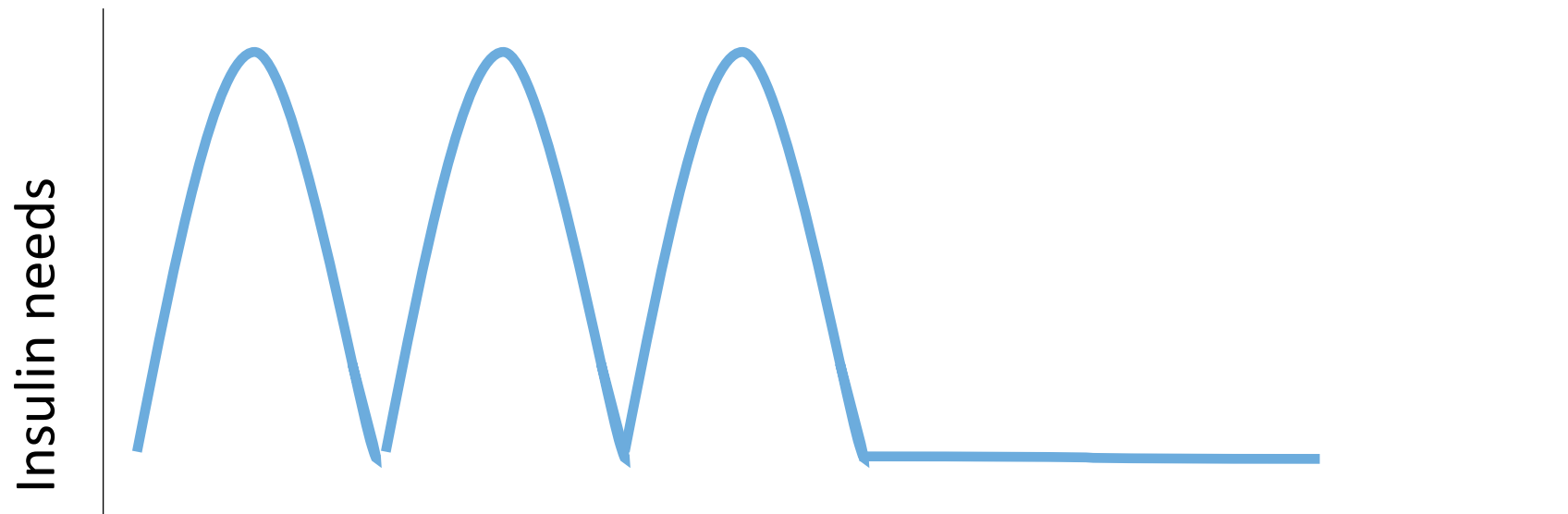
The difference between different types of manufactured insulin is timing

Long-Acting Insulins

- One injection delivers insulin over many hours (12-36 hours)
- Mimics background insulin needs

Short-Acting Insulins

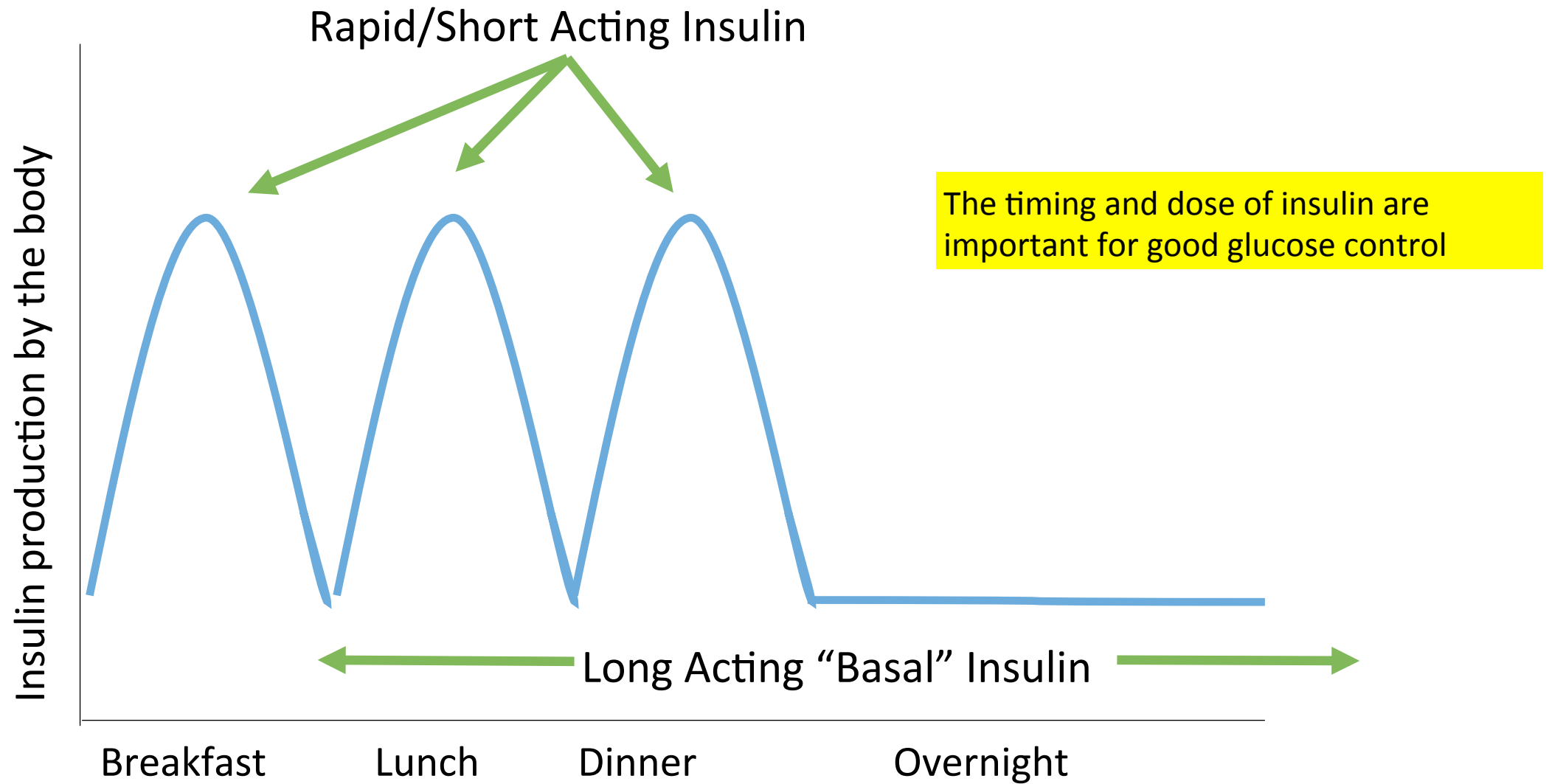
- One injection delivers insulin for a short time (2-6 hours)
- Mimics mealtime insulin needs



Long Acting “Basal” Insulins	Time to Onset	Duration of Action
Glargine	1 hour	24 hours Peakless
Detemir	1 hour	12-24 hours Small peak
NPH (Neutral Protamine Hagedorn)	1-2 hours	12-18 hours peaks ~6 hours
Degludec	1 hour	36 hours Peakless

Rapid or Short Acting Insulins	Time to Onset	Peak Action	Duration of Action
“Regular”	30 minutes	2-3 hours	6 hours
Aspart	15 minutes	1 hour	3-4 hours
Lispro	15 minutes	1 hour	3-4 hours
Glulisine	15 minutes	1 hour	3-4 hours

Insulin release from the pancreas



Timing and Dose of Long Acting (basal) Insulin

- Best to be given the same time each day
- The dose of basal insulin depends on:
 - Your weight
 - Amount of insulin resistance in your body
 - How much/how little insulin your pancreas makes

Timing and Dose of Mealtime Insulin

- Best to be given right before you start your meal
- The dose of mealtime insulin depends on:
 - The **amount of carbohydrates** you are about to eat
 - Amount of insulin resistance in your body
 - How much/how little insulin your pancreas makes

Sliding Scale Insulin

Blood Sugar	Insulin Dose
<150	0
151-200	1 unit
201-250	2 units
251-300	3 units

- Insulin given in reaction to a high sugar
- Not able to prevent a high blood sugar from happening
- Best used in conjunction w/ mealtime insulin

Take Home Points

- Insulin is necessary to utilize the energy we obtain from carbohydrates
- Insulin tells the cells of the body to store glucose
- Diabetes is characterized by a relative or absolute lack of insulin production
- There are long acting and short acting synthetic insulins
- Taking insulin in a way that mimics natural insulin production is best for keeping glucoses in a healthy range