TYPE 1 DIABETES

Education Phase 1

TYPE 1 DIABETES

Auto-immune condition - Yet **two** factors are important.
You inherit a ***predisposition*** to the disease, then something in your ***environment*** triggers it.

- One trigger might be related to cold weather.
- Type 1 Diabetes develops more often in winter than summer and is more common in places with cold climates.
- Another trigger might be viruses. Early diet may also play a role. Type 1 Diabetes is less common in people who were breastfed and in those who first ate solid foods at later ages.

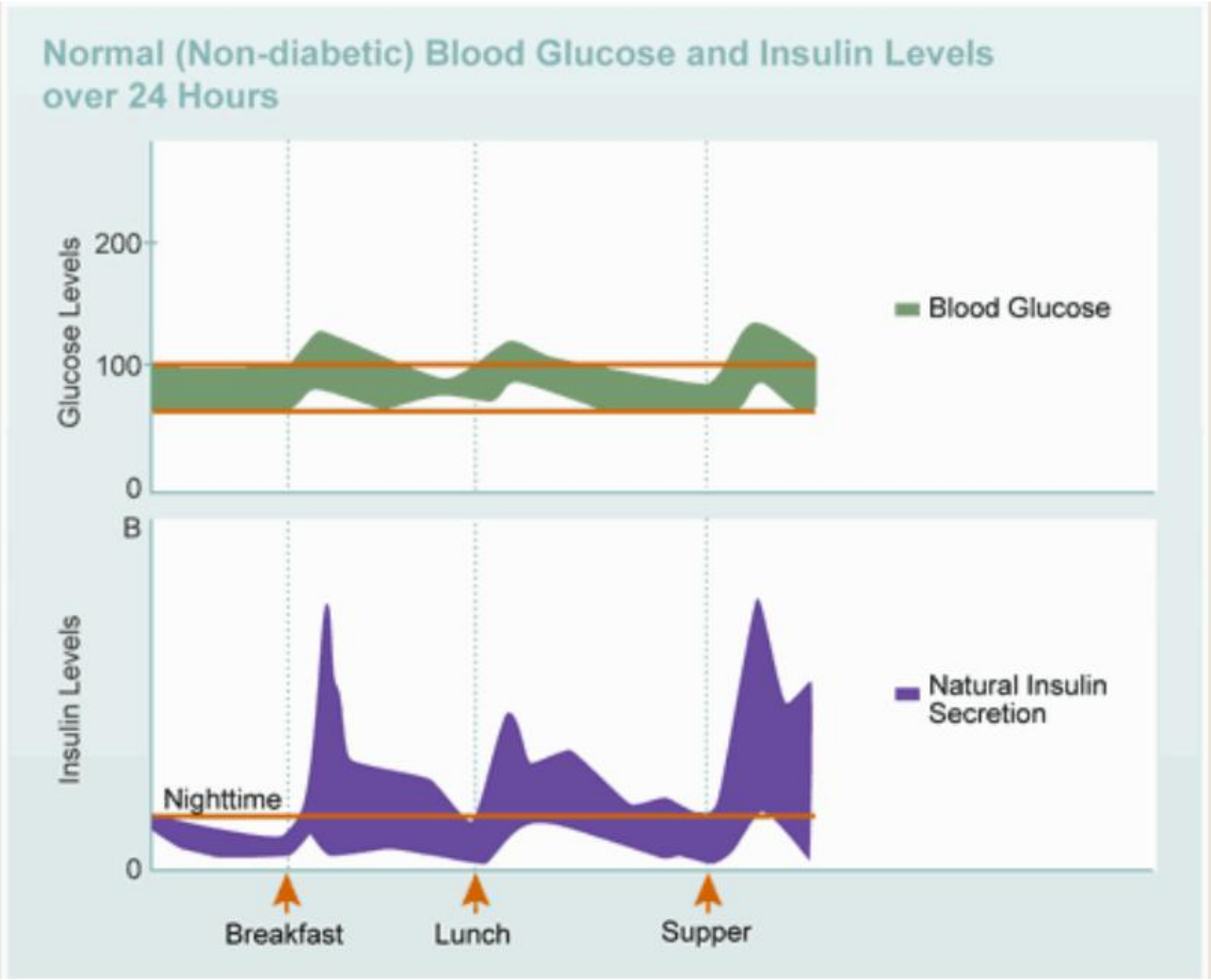
TYPE 1 DIABETES - YOUR CHILDS RISK

If you are a man with Type 1 Diabetes, the odds of your child developing diabetes are **1 in 17**.

If you are a woman with Type 1 Diabetes and your child was born ***before*** you were 25, your child's risk is **1 in 25**; if your child was born ***after*** you turned 25, your child's risk is **1 in 100.**

Your child's risk is doubled if you developed diabetes ***before*** age 11. If both you and your partner have Type 1 Diabetes, the risk is between **1 in 10** and **1 in 4.**

Source - ADA



THE EFFORT:
Of an insulin regimen is to ***MIMIC*** the body's natural physiology

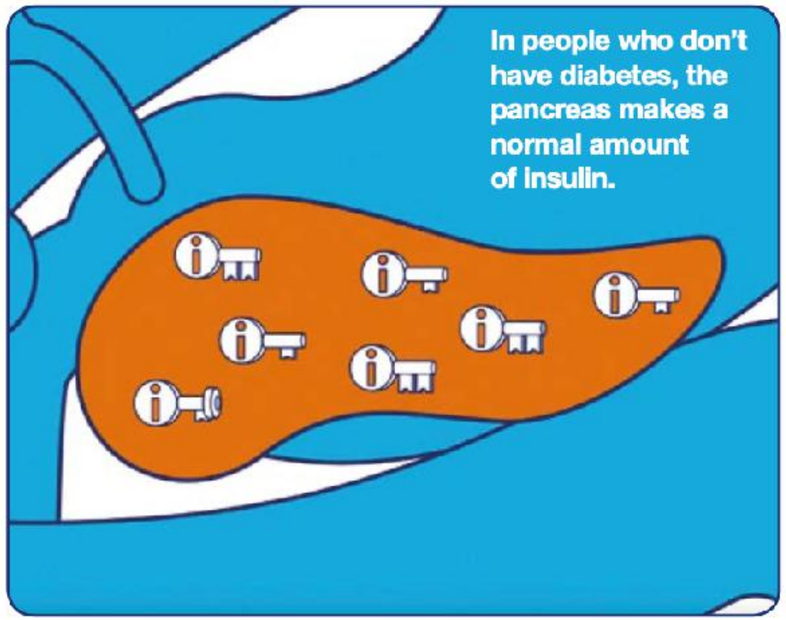
INSULIN

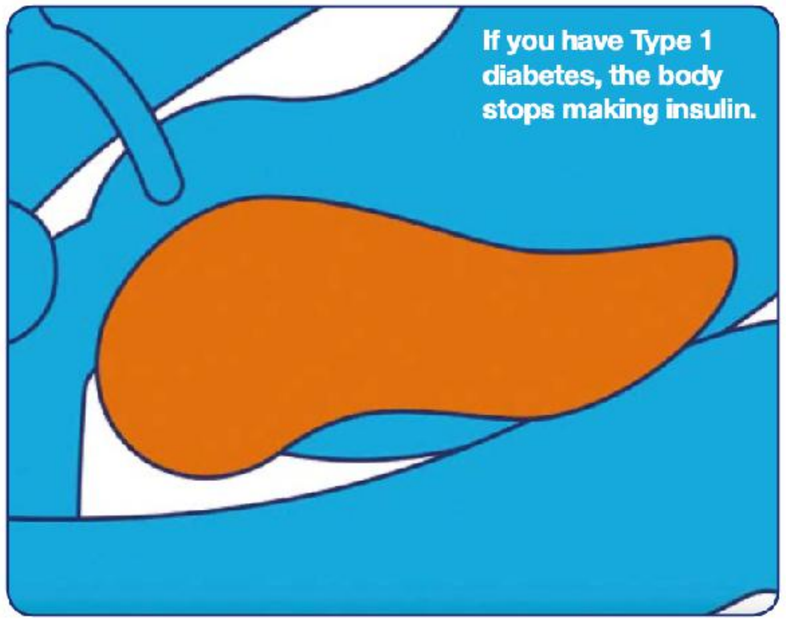
When you eat, your body breaks down **carbohydrates**, into **glucose**. (*Carbs are in starchy foods, like bread, potatoes and pasta. They're also in fruit, some dairy, sugar and other sweet food.)*

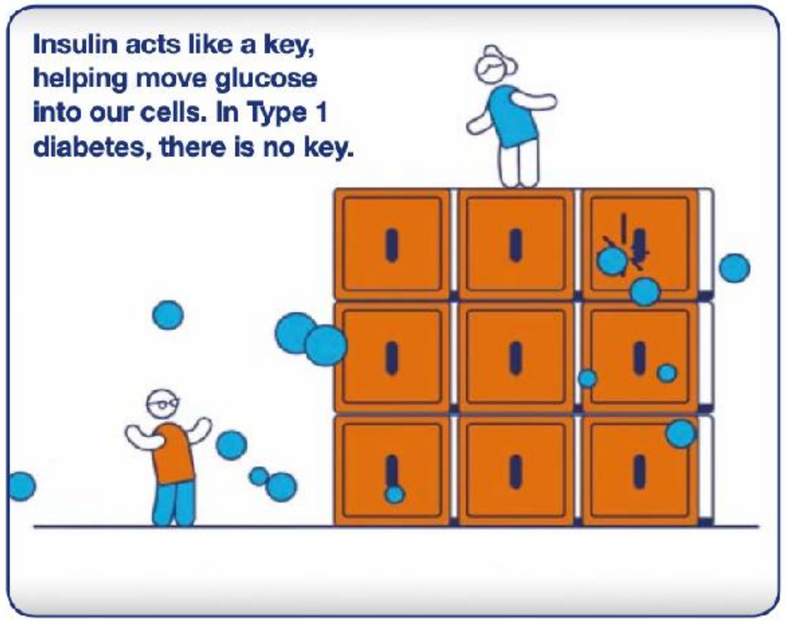
The glucose is taken into your **bloodstream**. **Insulin is needed to move this glucose into the cells in your body, so that it can be used as energy.**

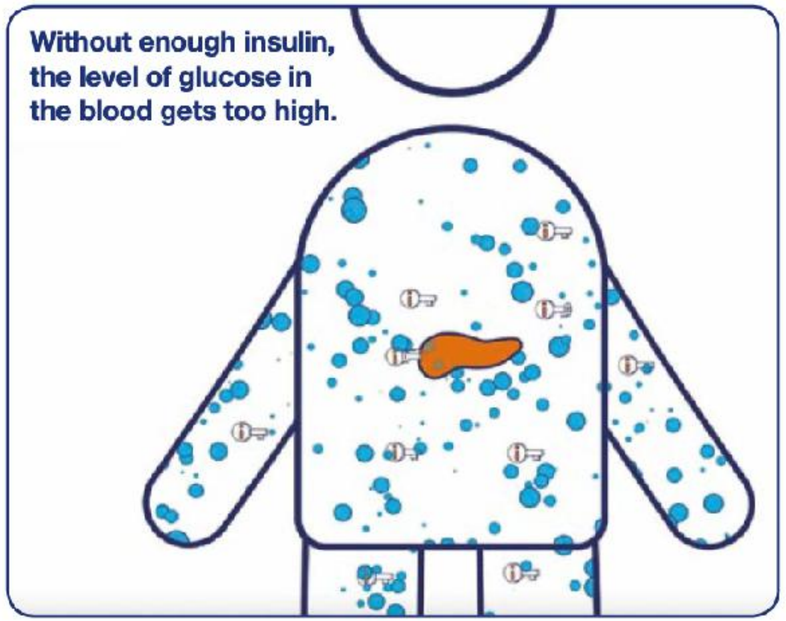
In a person without Type 1 Diabetes, that insulin is produced by the ***pancreas***.

In someone with Type 1 Diabetes, an autoimmune reaction in the pancreas has killed off the insulin- producing cells. So you don't make any insulin – and glucose builds up in your blood.







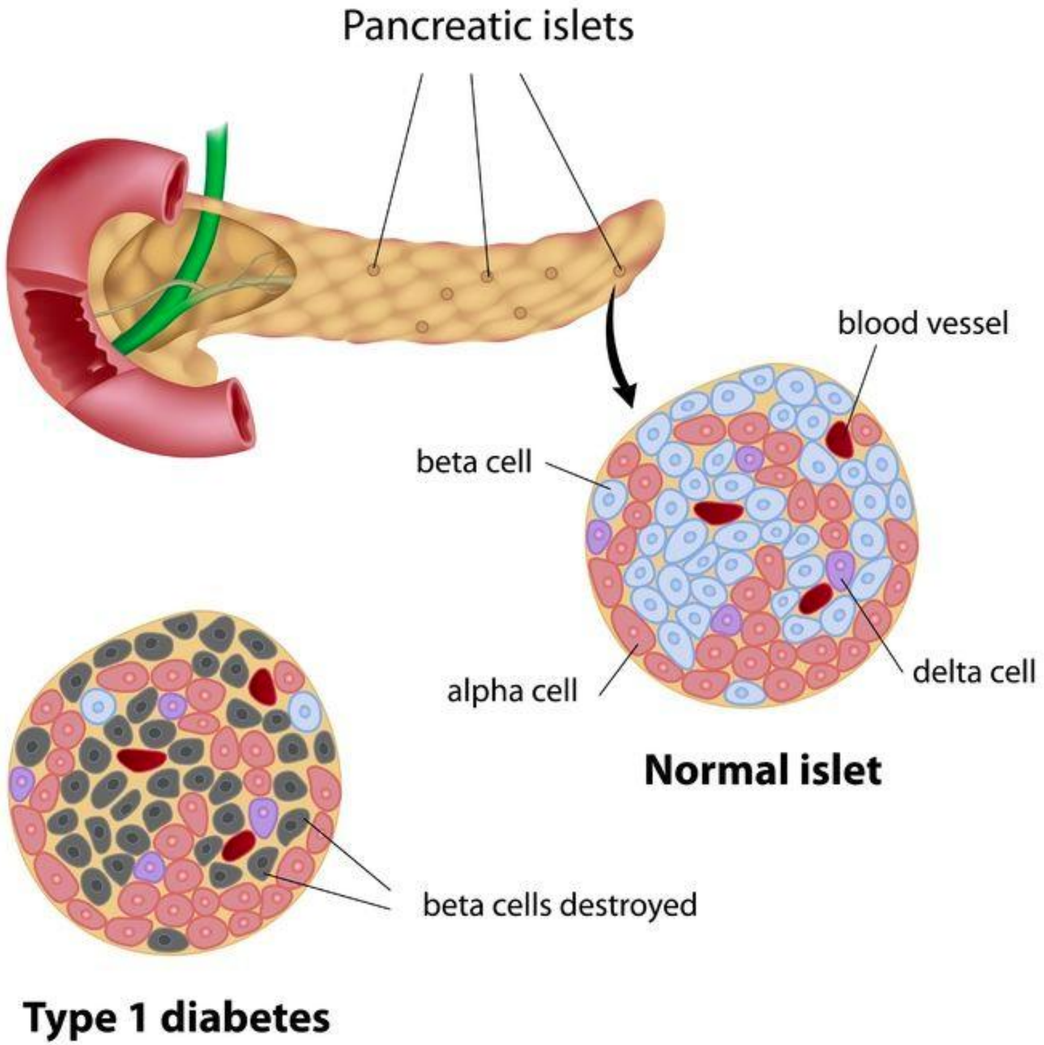


INSULIN

Inside the pancreas, the hormone **insulin** is made in the beta cells, which are part of the **Islets** of Langerhans.

These islets also have **alpha cells, which make glucagon**, as well as delta cells. With each meal, **beta cells release insulin to help the body use or store the blood sugar it gets from food.**

In the beta cells, insulin is created first as a big molecule called **“proinsulin.”** Proinsulin is broken into two pieces: **insulin and C-peptide**. C-peptide is important especially when determining treatment because it can be used to measure how much insulin a person is making. The more C-peptide a person has, the more insulin they are making. This can help a provider determine how much insulin to prescribe.

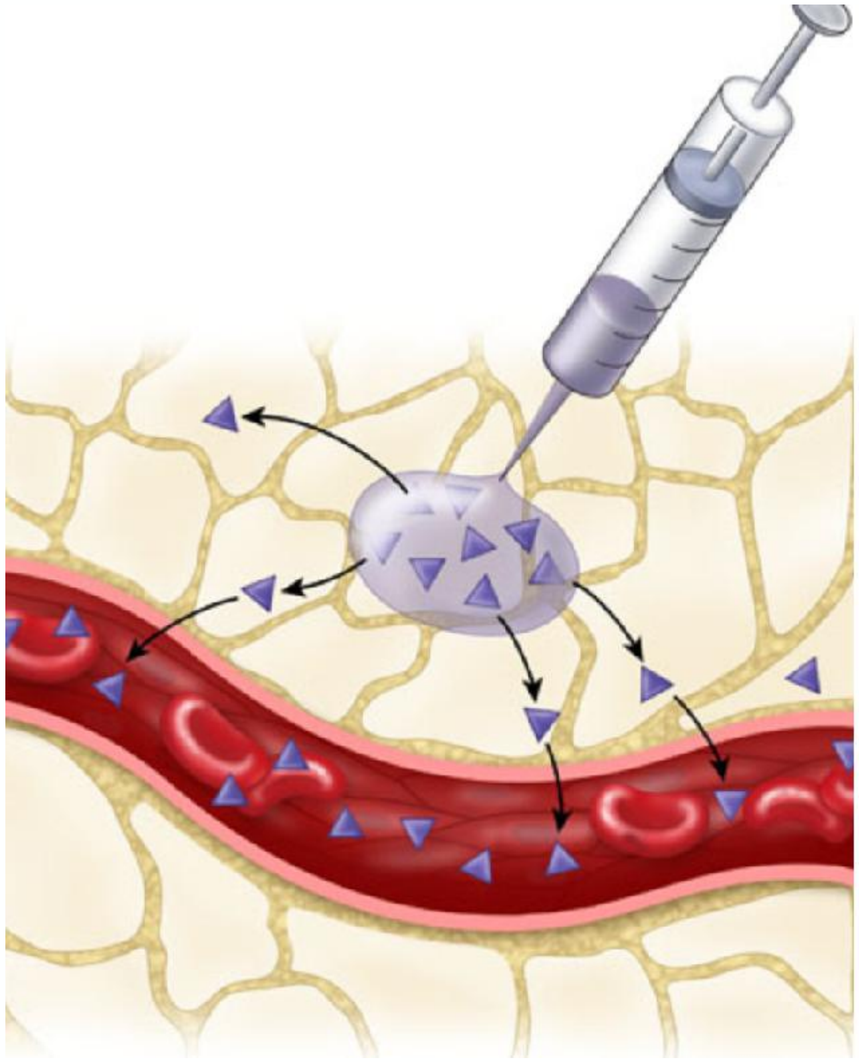


INSULIN – MAIN TYPES

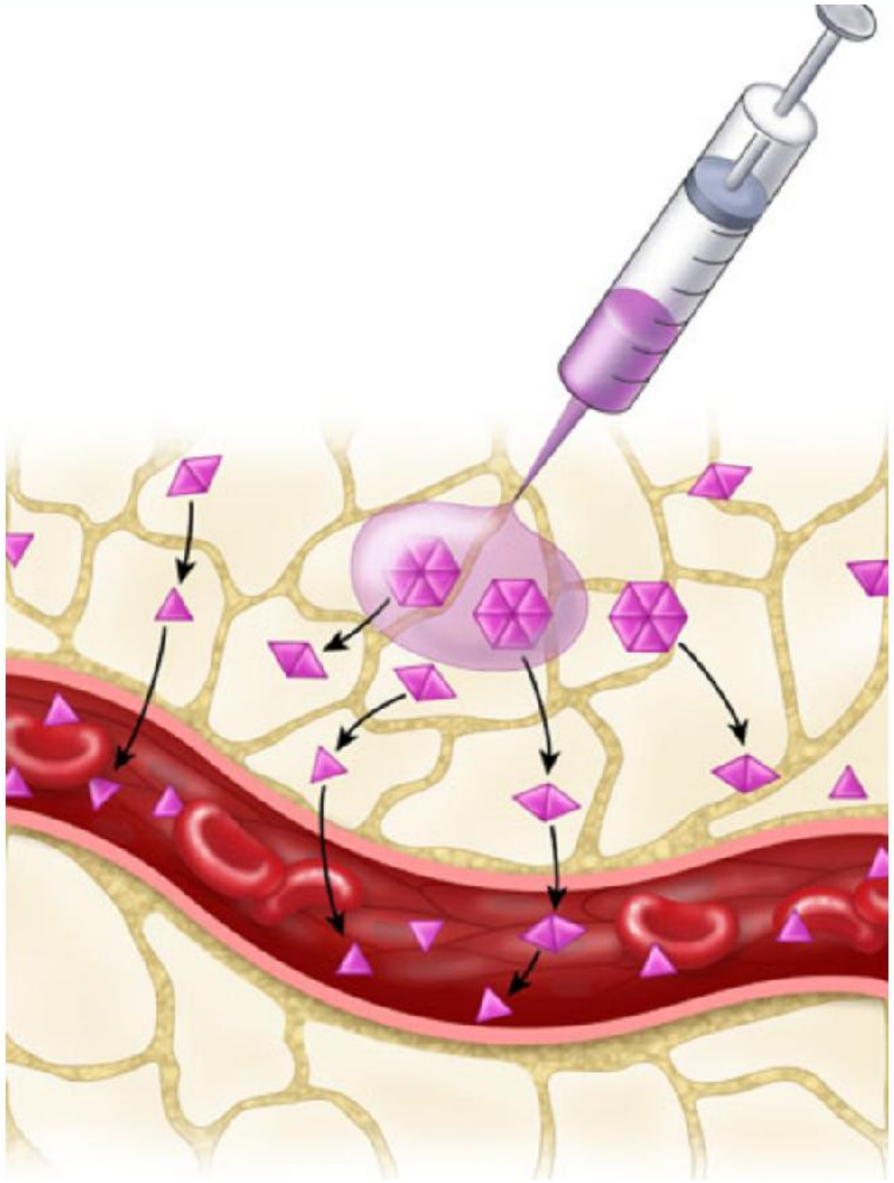
HUMAN INSULIN - Synthetic human insulin is identical in structure to your own ***natural*** insulin.

ANALOGS - "insulin" analogs are analogs that have been designed to ***mimic*** the body's natural pattern of insulin release. These synthetic-made insulins are called analogs of human insulin. However, they have minor structural or amino acid changes that give them special desirable characteristics when injected under the skin. Once absorbed, they act on cells like human insulin, but are absorbed from ***fatty tissue*** more predictably.

Insulin analogs have been developed because human insulins have limitations when injected under the skin. In high concentrations, such as in a vial or cartridge, human (and also animal insulin) clumps together. This clumping causes slow and unpredictable absorption from the ***subcutaneous tissue*** and a dose-dependent duration of action (i.e. the larger dose, the longer the effect or duration)



ANALOG INSULIN



HUMAN INSULIN

INSULIN – CHARACTERISTICS

- **Onset** is the length of time before insulin reaches the bloodstream and begins lowering blood sugar.
- **Peak** is the time during which insulin is at maximum strength in terms of lowering blood sugar.
- **Duration** is how long insulin continues to lower blood glucose.

INSULIN – TYPES

- There are **three** main groups of insulins:

Fast - Acting (also known as short)

Intermediate-acting

Long-acting insulin

FAST ACTING INSULIN (SHORT ACTING)

- Is absorbed quickly from your ***fat tissue*** (subcutaneous) into the bloodstream.
- Is used to control the blood sugar ***during meals and snacks*** and to correct high blood sugars

Rapid Acting Insulin Analogs

Insulin Aspart, insulin Lyspro, Insulin Glulisine

which have an onset of action of 5 to 15 minutes,
peak effect in 1 to 2 hours and duration of action
that lasts 4-6 hours.
With all doses, large and small,
the onset of action and the time to peak effect is similar.

Regular Human Insulin

which has an onset of action of 1/2 hour to 1 hour, peak effect in 2 to 4 hours, and duration of action of 6 to 8 hours. The larger the dose of regular the faster the onset of action, but the longer the time to peak effect and the longer the duration of the effect.

INTERMEDIATE ACTING INSULIN

- Is absorbed more ***slowly, and lasts longer***
- Is used to control the blood sugar ***overnight***, while ***fasting*** and between meals

NPH Human Insulin

which has an onset of insulin effect of 1 to 2 hours, a peak effect of 4 to 6 hours, and duration of action of more than 12 hours.

PRE-MIX Insulin

which is NPH pre-mixed with either regular human insulin or a rapid-acting insulin analog. The insulin action profile is a combination of the short and intermediate acting insulins.

LONG ACTING INSULIN

- Is absorbed ***slowly***, has a minimal peak effect, and a stable plateau effect that ***lasts most of the day.***
- Is used to control the blood sugar ***overnight***, while ***fasting and between meals***

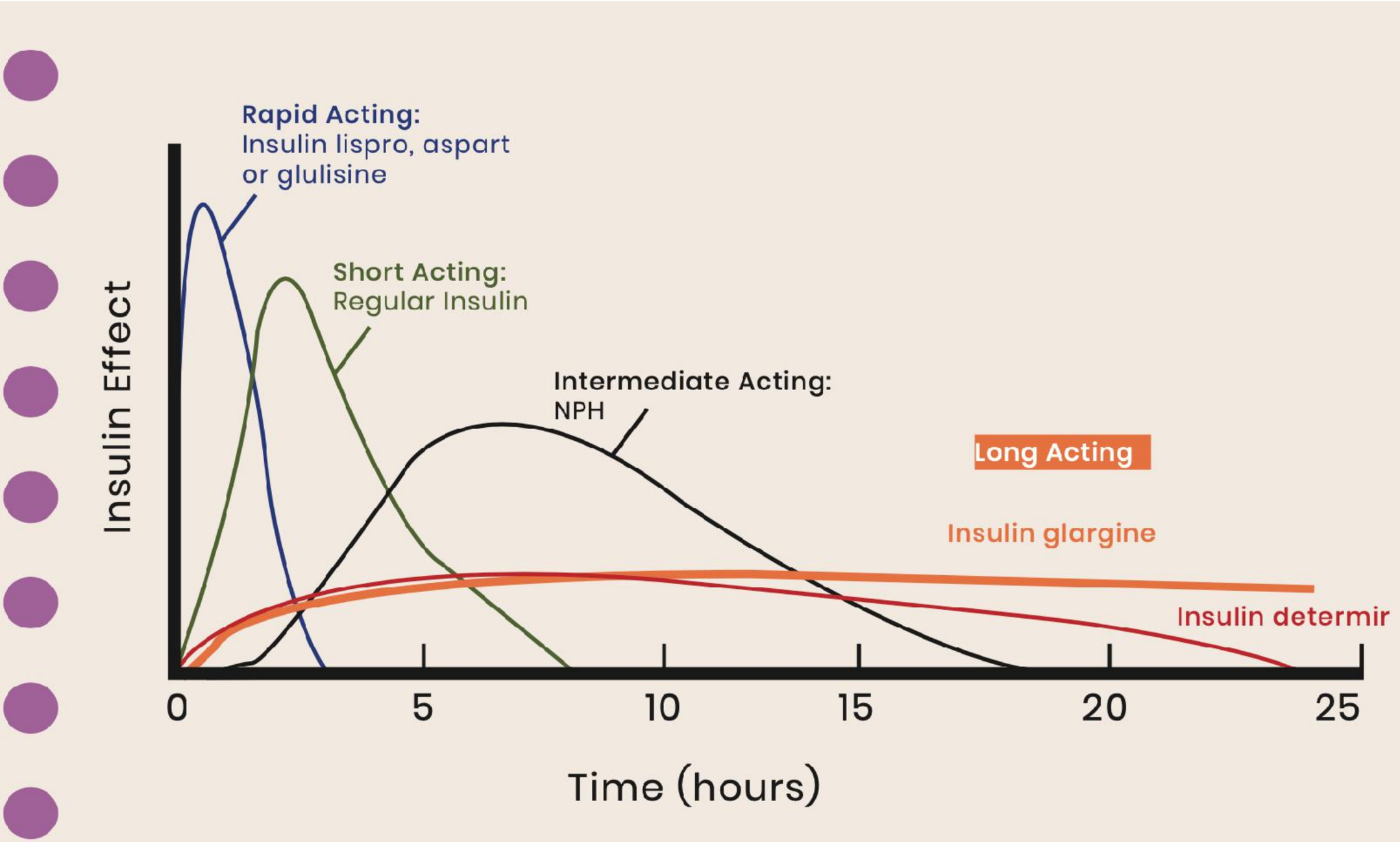
Long Acting Analogs

which have an onset of insulin effect in 1 1/2-2 hours. The insulin effect plateaus over the next few hours and is followed by a relatively flat duration of action that lasts 12-24 hours for insulin detemir and 24 hours for insulin glargine.

Insulin Glargine, Insulin Detemir

INSULIN CHART

Brand Name	Generic Name	Type	Onset	Peak	Duration
Apidra	Insulin Glulisine	Rapid Acting	15 minutes	1 hour	2-4 hours
Humalog	Insulin Lispro	Rapid Acting	15 minutes	1 hour	2-4 hours
NovoRapid	Insulin Aspart	Rapid Acting	15 minutes	1 hour	2-4 hours
Huminsulin R	Human Regular	Regular Short Acting	30 minutes	2-3 hours	3-6 hours
Actrapid	Human Regular	Regular Short Acting	30 minutes	2-3 hours	3-6 hours
Huminsulin N	NPH	Intermediate Acting	2-4 hours	4-12 hours	12-18 hours
Insulatard	NPH	Intermediate Acting	2-4 hours	4-12 hours	12-18 hours
Levemir	Insulin Detemir	Long Acting	Several hours	No peak	24 hours
Lantus	Insulin Glargine	Long Acting	Several hours	No peak	24 hours
Mixtard 70/30		Combination/ Pre-Mixed	30 minutes - 1 hour	3.5 hours	18-24 hours
Novomix 70/30		Combination/ Pre-Mixed	Less than 15 minutes	1-4 hours	Up to 24 hours
Humalog Mix 75/25 or 50/50		Combination/ Pre-Mixed	Less than 15 minutes	1-6 hours	13-22 hours
Toujeo	Insulin Glargine u-300	Ultra Long Acting	6 hours	No peak	Up to 36 hours
Afrezza		Inhaled	12-15 minutes	30 minutes	1.5-4 hours


Rapid Acting:
Insulin lispro, aspart
or glulisine
Short Acting:
Regular Insulin
Intermediate Acting:
NPH
Long Acting
Insulin glargine
Insulin determir
Insulin Effect
0
5
10
15
20
25
Time (hours)

INSULIN REGIMENS – TWICE DAILY

- Twice daily insulin regimens may be suitable for people with ***type 1*** and ***type 2*** diabetes.
- It is important that people on a twice daily regimen keep to a ***consistent daily routine*** that includes ***three meals a day.***
- A twice daily insulin regimen is described as being ***biphasic*** because it has two phases of activity.
- At each injection you will take a mixture of ***short acting and intermediate acting*** insulin.
- The insulin will either need to be manually mixed via syringe or, alternatively, you may take pre-mixed insulin.
- In type 1 diabetes, a twice daily regimen is suitable in people who have a ***consistent*** day to day routine.
- A twice daily regimen may allow some flexibility for ***adjusting doses*** but not as much as a ***basal-bolus regimen.***

INSULIN REGIMENS – BASAL BOLUS

A basal-bolus regimen, also known as ***multiple daily injection therapy***, involves taking a long ***acting or intermediate acting dose*** and separate injections of short or rapid acting insulin at each meal.

A basal-bolus regimen is commonly used by people with type 1 diabetes and may also be suitable for people with type 2 diabetes.

An advantage of a basal-bolus regimen is that it offers more ***flexibility*** over when meals are taken and also allows doses to be varied in response to different ***carbohydrate quantities in meals.***

INSULIN REGIMENS – FIXED / FLEXIBLE DOSE

FIXED DOSE INSULIN THERAPY

- On a fixed dose insulin therapy, the amount of insulin you take at each meal will ***not vary*** from day to day.
- You can be on any of the above injection regimens and on a ***fixed dose therapy***.
- A fixed dose therapy can help to simplify the understanding of blood glucose results but does not offer the flexibility of how much ***carbohydrate*** you choose to consume at each meal that a ***flexible insulin therapy*** does.

FLEXIBLE INSULIN THERAPY

- On a flexible insulin therapy you choose ***how much insulin*** you inject at each meal.
- Flexible insulin therapy is particularly common for people on a ***basal-bolus*** insulin regimen.
- Flexible insulin therapy gives you more control of what you eat and how your balance your blood glucose levels but will take ***time and commitment*** to learn how best to adjust your insulin doses.

INSULIN - STRENGTH

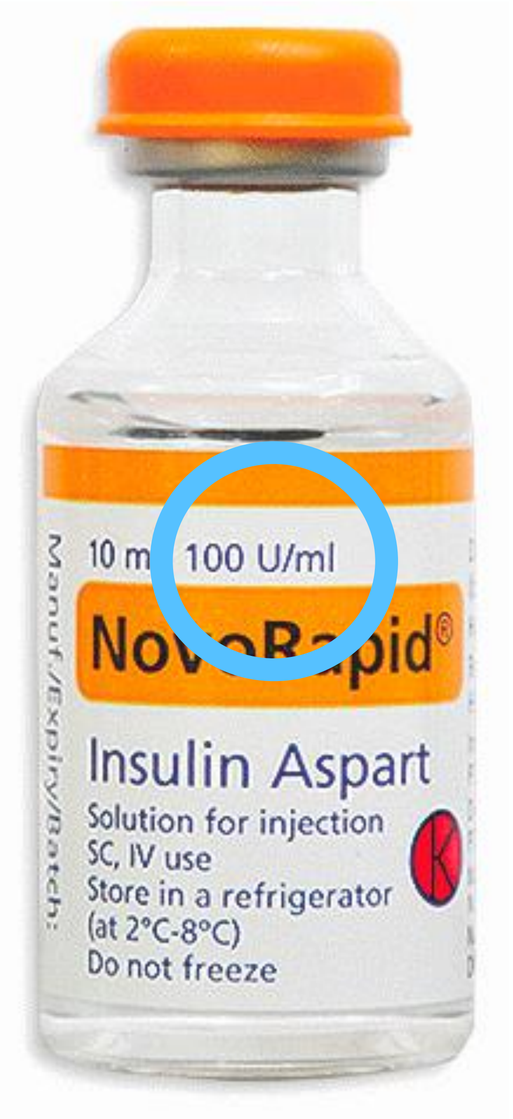
IU = One International Unit (IU)

All insulins come dissolved or suspended in liquids.

The standard and most commonly used strength in the world today is U-100, which means it has **100 units of insulin per milliliter of fluid,** though U-500 insulin is available for patients who are extremely insulin resistant.

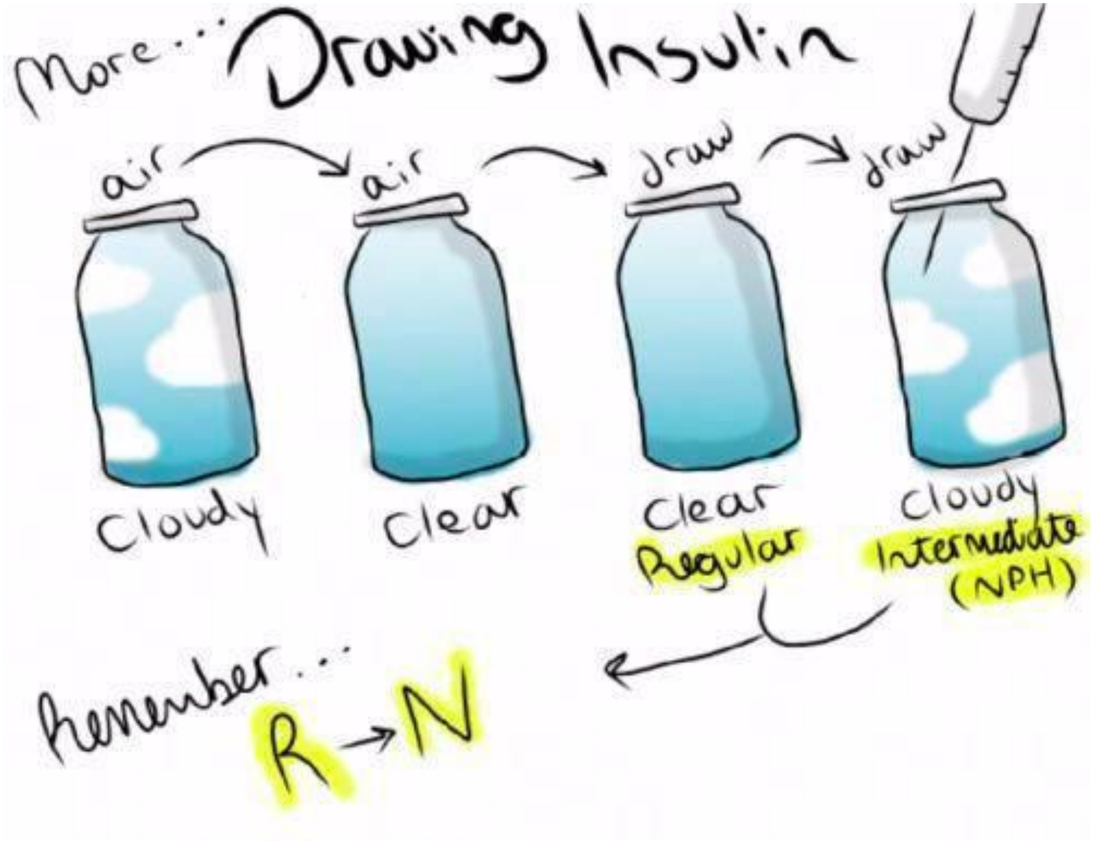
U-40, which has 40 units of insulin per milliliter of fluid, has generally been phased out around the world, but it is possible that it could still be found in some places (and U-40 insulin is still used in veterinary care).

Never use U-100 insulin in U-40 syringe or vice versa - you will get an unpleasant surprise.



CLOUDY VS CLEAR

Mixed insulins and some intermediate acting appear cloudy in nature



Some insulins need to be MIXED in the syringe.

AIR AIR DRAW DRAW
CLOUDY CLEAR CLEAR CLOUDY

INSULIN SENSITIVITY FACTOR

An ISF or correction factor describes how much one unit of rapid or regular insulin will lower your blood sugar by. It is used to determine the amount of insulin to give to correct blood glucose readings that are above target.

- ***Formula: 1800/Total Daily Dose***
  Total Daily Dose (TDD): Basal + total bolus in a day.

  FOR EXAMPLE:
  If I take 25 units basal and 25 total units of bolus, my TDD is 50.
  Therefore, 1800/50 = 36. This means that 1 unit of insulin will lower my sugar by 36 mg/dL.

  How to use:
  Lets say my sugar is 300mg/dL right now and I have not taken insulin for 2 hours.

- ***Forumla for correction:***
  (Current BG - Target BG) / ISF
  therefore: (300 - 120) / 36
  180 / 36 = 5
  I will take 5 units of insulin as correction!

INSULIN DOSE ADJUSTMENT

Use the insulin to Carb ratio to calculate how much insulin to take when eating: The amount of insulin you need with food is called the 'insulin to carbohydrate ratio'. This ratio varies from person to person and time of day.

500/TDD (TOTAL DAILY DOSE)

TDD = Basal + total bolus

FOR EXAMPLE:
If my basal for a day is 25 units and my total bolus is 25, my total daily dose is 50. Therefore 500/50 = 10. Which means 1 unit of insulin will take care of 10 grams of carbs.

If my lunch is 40g of carbs I have to inject 4 units of insulin.

These situations may require a change in insulin dosage algorithm:

Higher doses (basal and bolus) of insulin may be needed:

- If you are sick, or have an infection
- If you reduce your level of activity
- If you gain weight
- If you are prescribed a medicine that changes your insulin sensitivity (such as Prednisone)
- If you are under emotional stress
- During adolescence
- During pregnancy

Lower doses (basal and bolus) of insulin may be needed:

- If you become more active
- If you lose weight
- If you have problems with kidney function

QUESTIONS?