

Definition & Pathophysiology of Type 2 Diabetes

Hallberg Legacy Course

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Type 2 Diabetes

Classic definition

“...a condition that happens because of a problem in the way the body regulates and uses [glucose] as a fuel.”

My definition

Insulin resistance with possible β -cell failure

Type 2 Diabetes

2

Insulin
Resistance

β



Diabetes



Insulin
Resistance

Glucose



Historic

Scientific





Diabetes

Insulin
Resistance

Decades
before
glucose

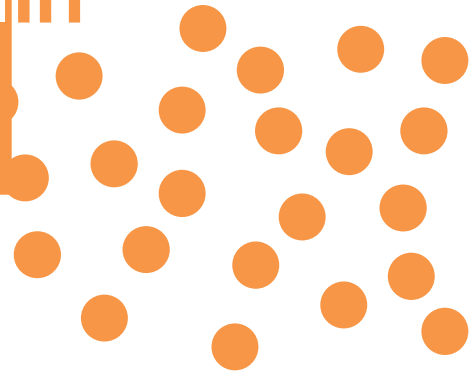
Insulin

What is insulin resistance?

Diabetes

Insulin
Resistance

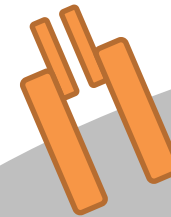
Insulin



Glucose



In some cells...



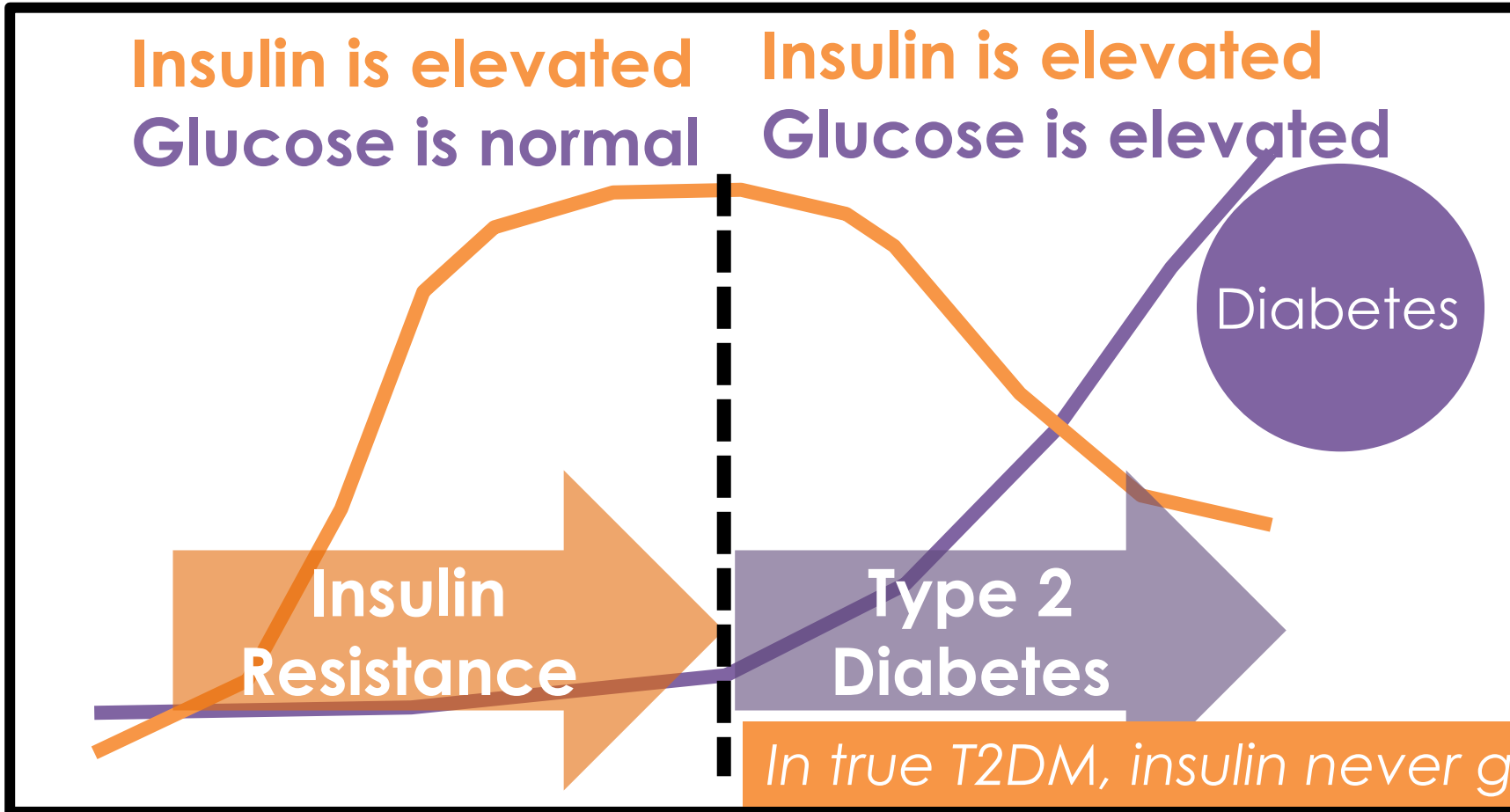


Some cells fail to fully respond to insulin

Insulin levels are high

There is no “insulin resistance” without hyperinsulinemia

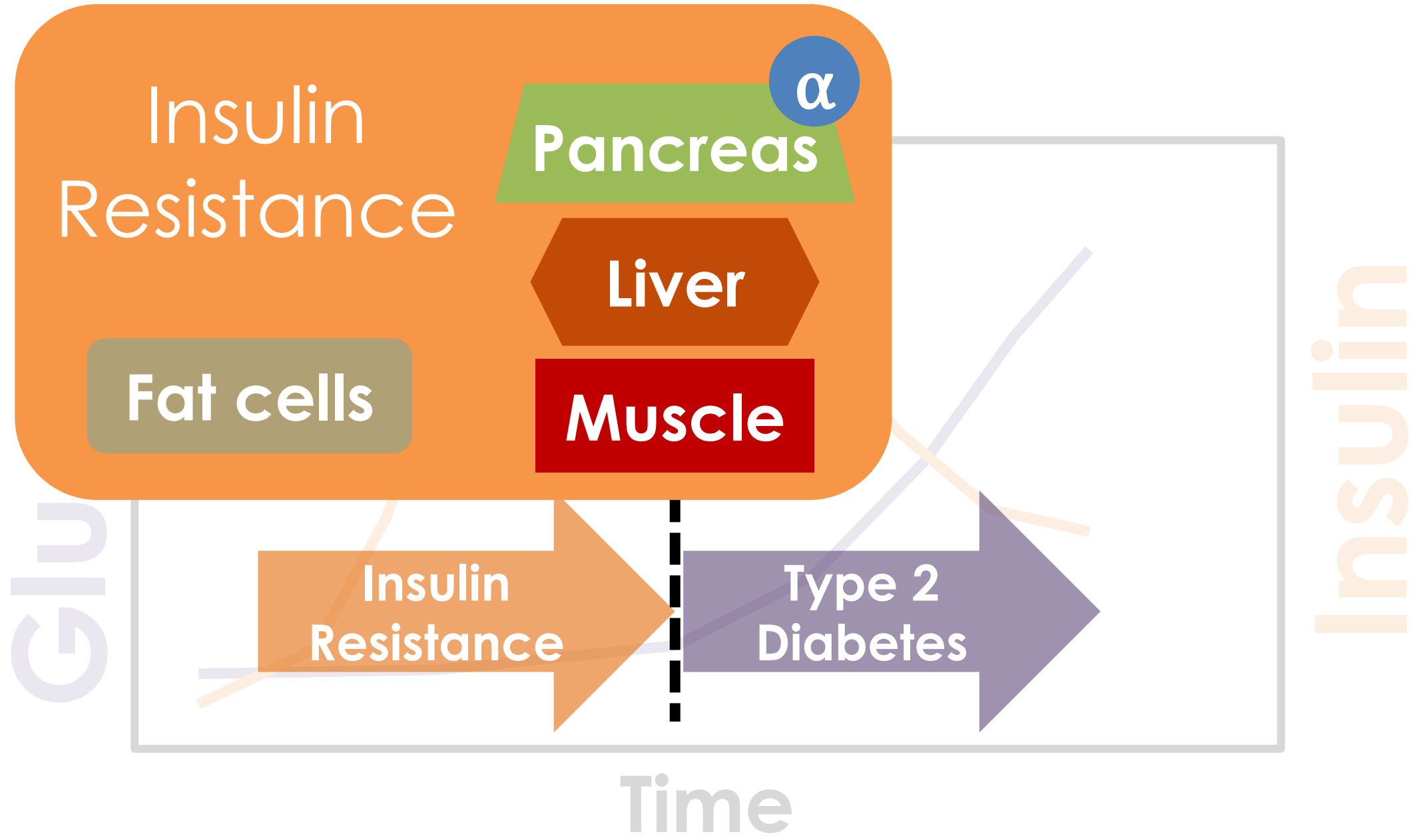
Glucose



Insulin

Time
(years)





Insulin
Resistance

Fat cells

Insulin
Resistance

Insulin

Glucose

Type 2
Diabetes

Insulin

Glucose

α
Pancreas

Liver

Muscle



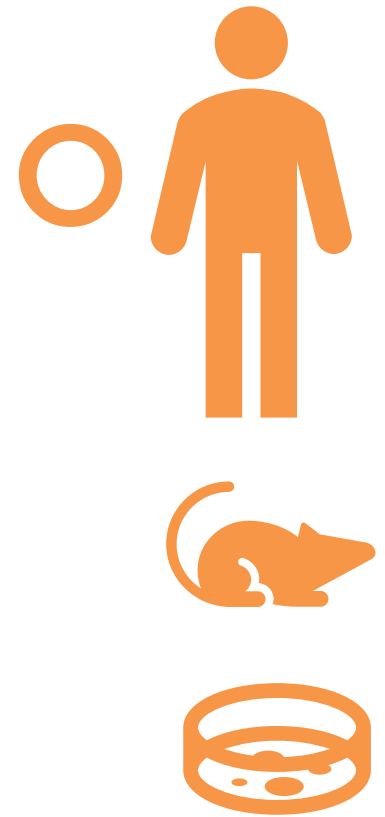
Diabetes

Insulin
Resistance

Where does it come from?

Insulin
Resistance
Stress

1



Inflammation

Hyperinsulinemia

Stress

Insulin

Cortisol

Epinephrine

Glucose

PMID: 31126054
PMID: 30145227
PMID: 31098674
PMID: 27614803

Inflammation

**Insulin
Sensitivity**

Infection/Illness

Air Pollution

Cytokines

**Autoimmune
Disorders**

**Enlarged
Fat Cells**

Hyperinsulin

Insulin
Sensitivity

Insulin

Any constant stimulus will eventually lead to a
resistance to that stimulus



Diabetes

Insulin
Resistance

How does it become T2DM?

Insulin Resistance

Fat cells

Pancreas α

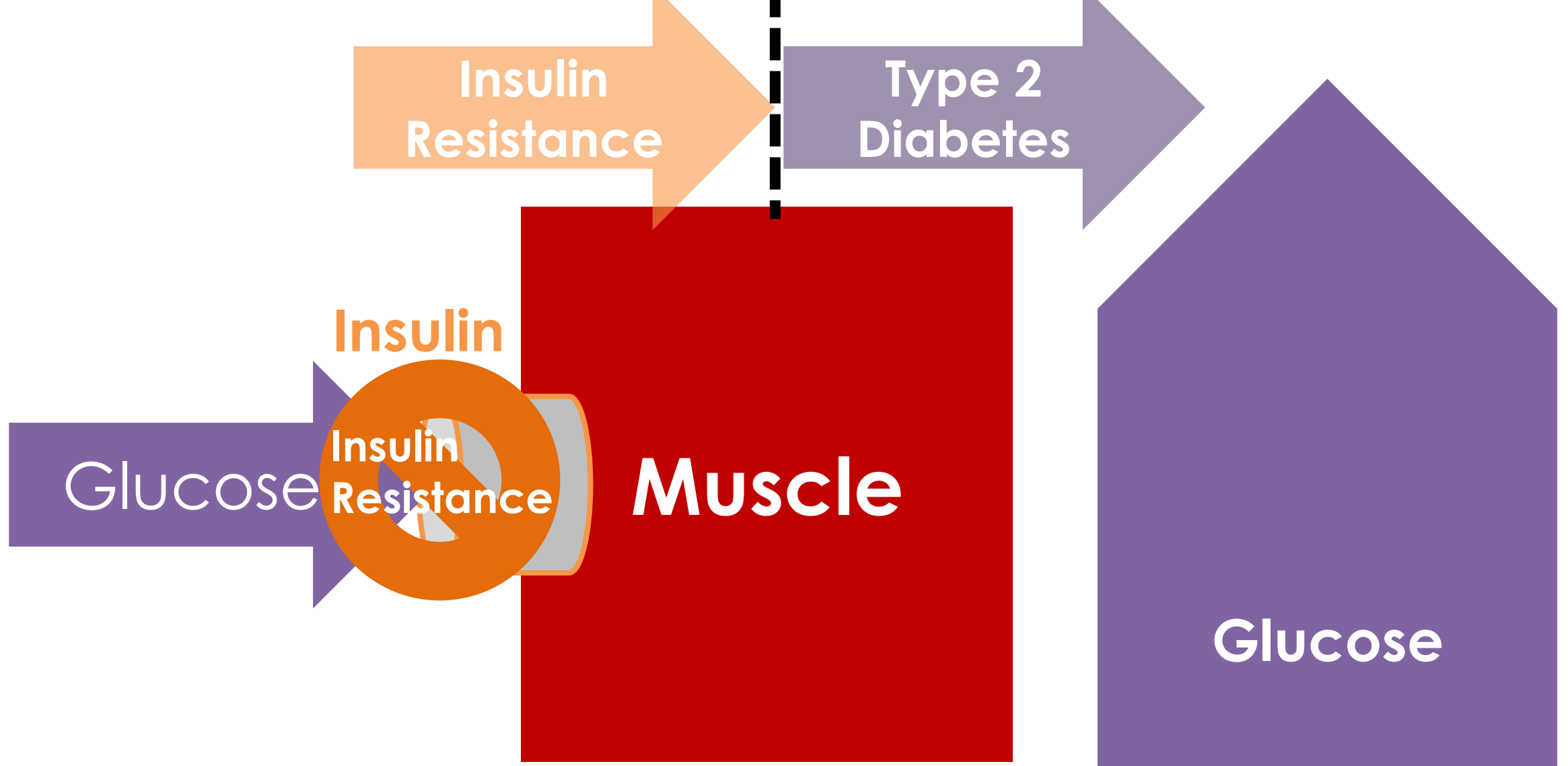
Liver

Muscle

Stress

Inflammation

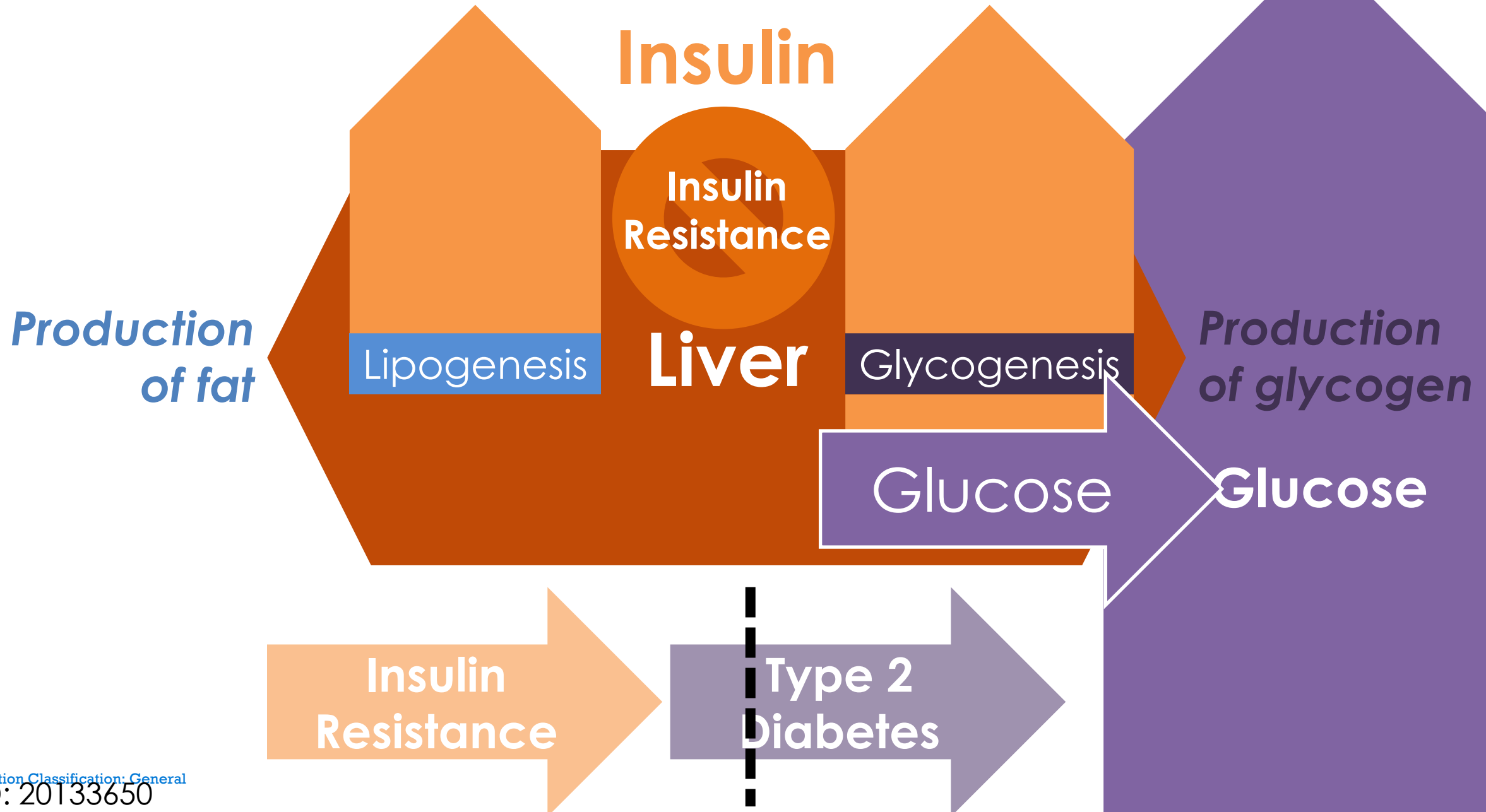
Hyperinsulinemia



Muscle is the main consumer of glucose



This is why TG are a good indicator of IR...



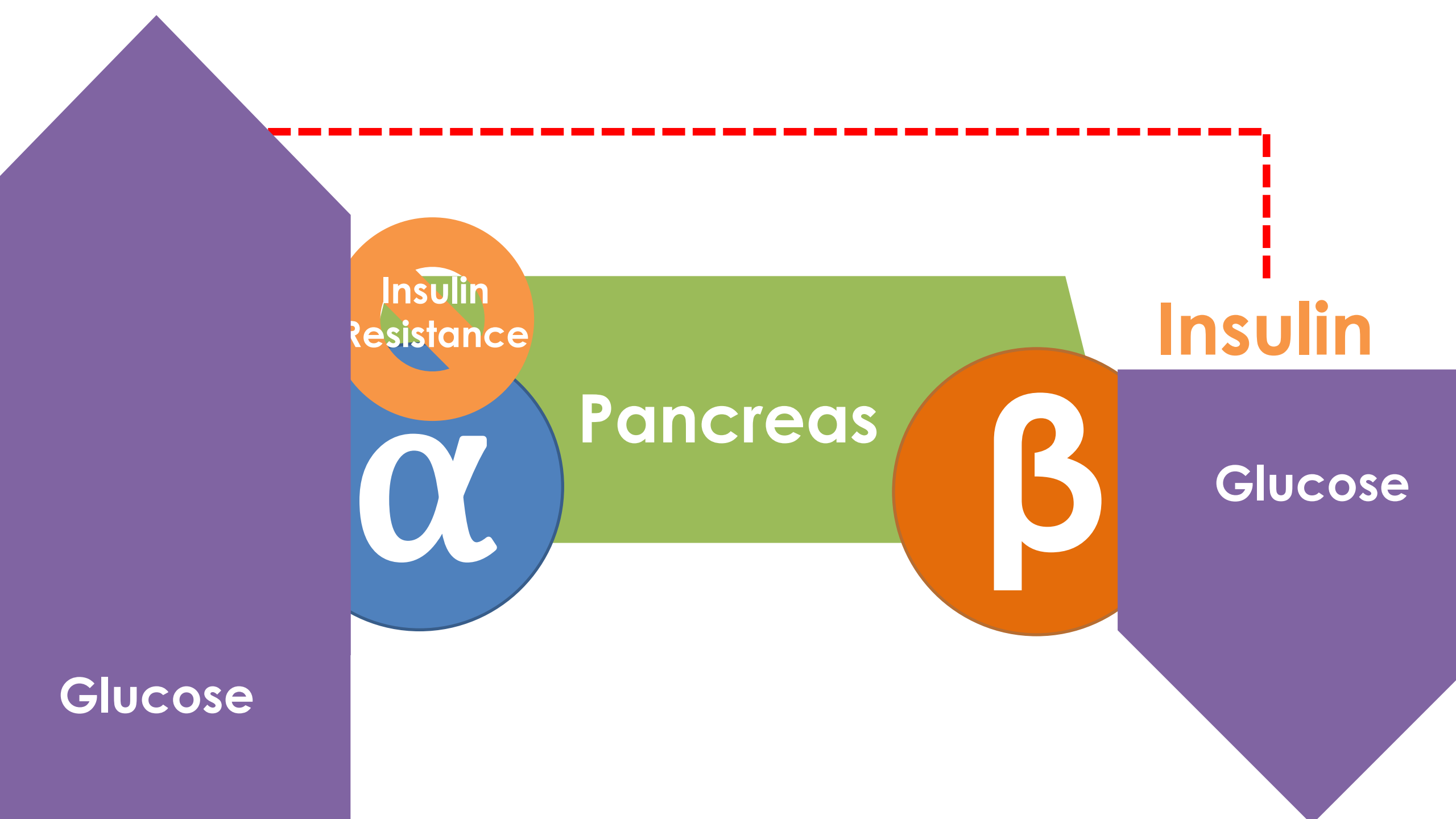
Glucagon



Pancreas



Insulin



Insulin
Resistance

α

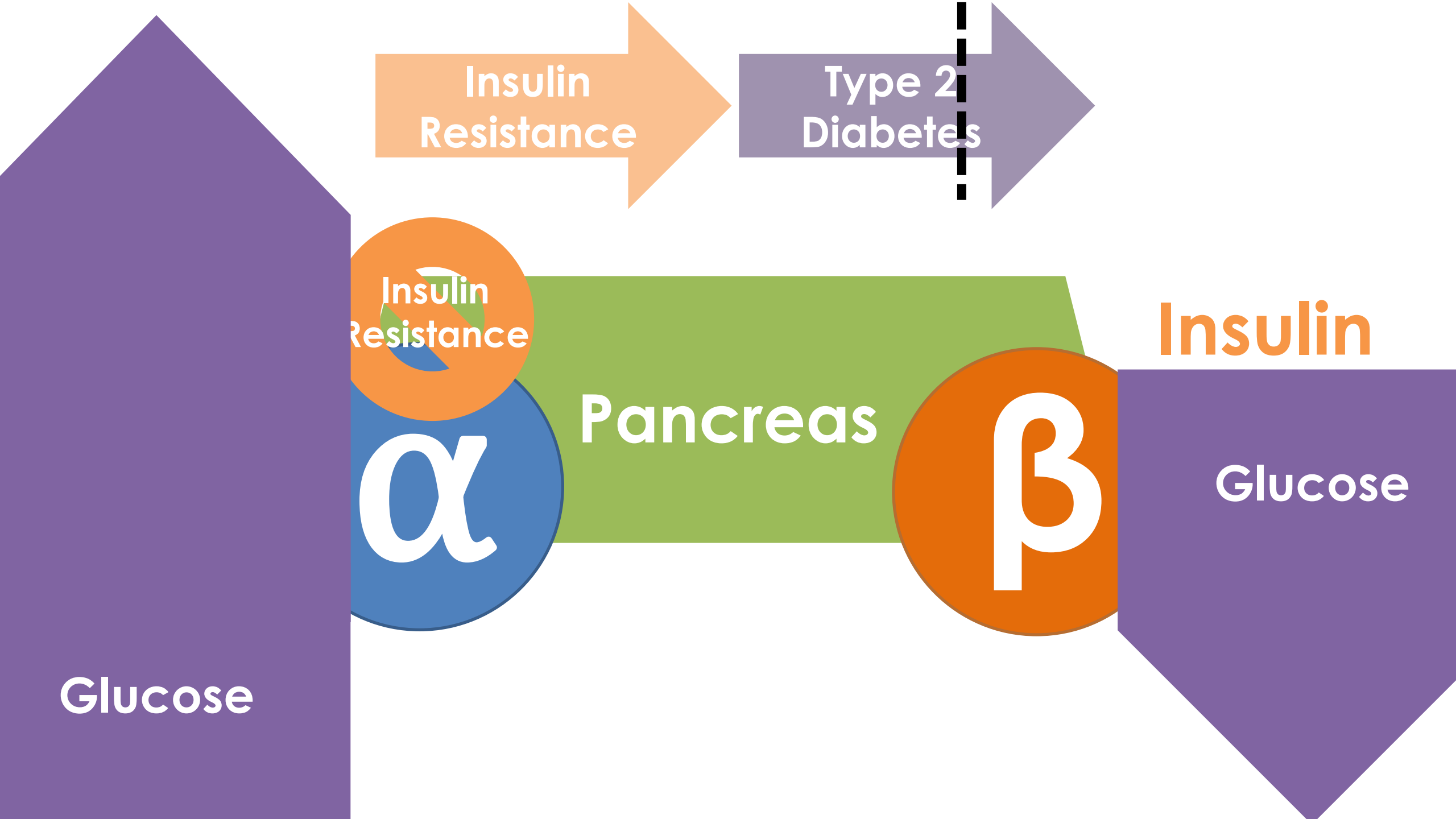
Pancreas

β

Insulin

Glucose

Glucose



Insulin
Resistance

Type 2
Diabetes

Insulin
Resistance

α

Pancreas

β

Insulin

Glucose

Glucose

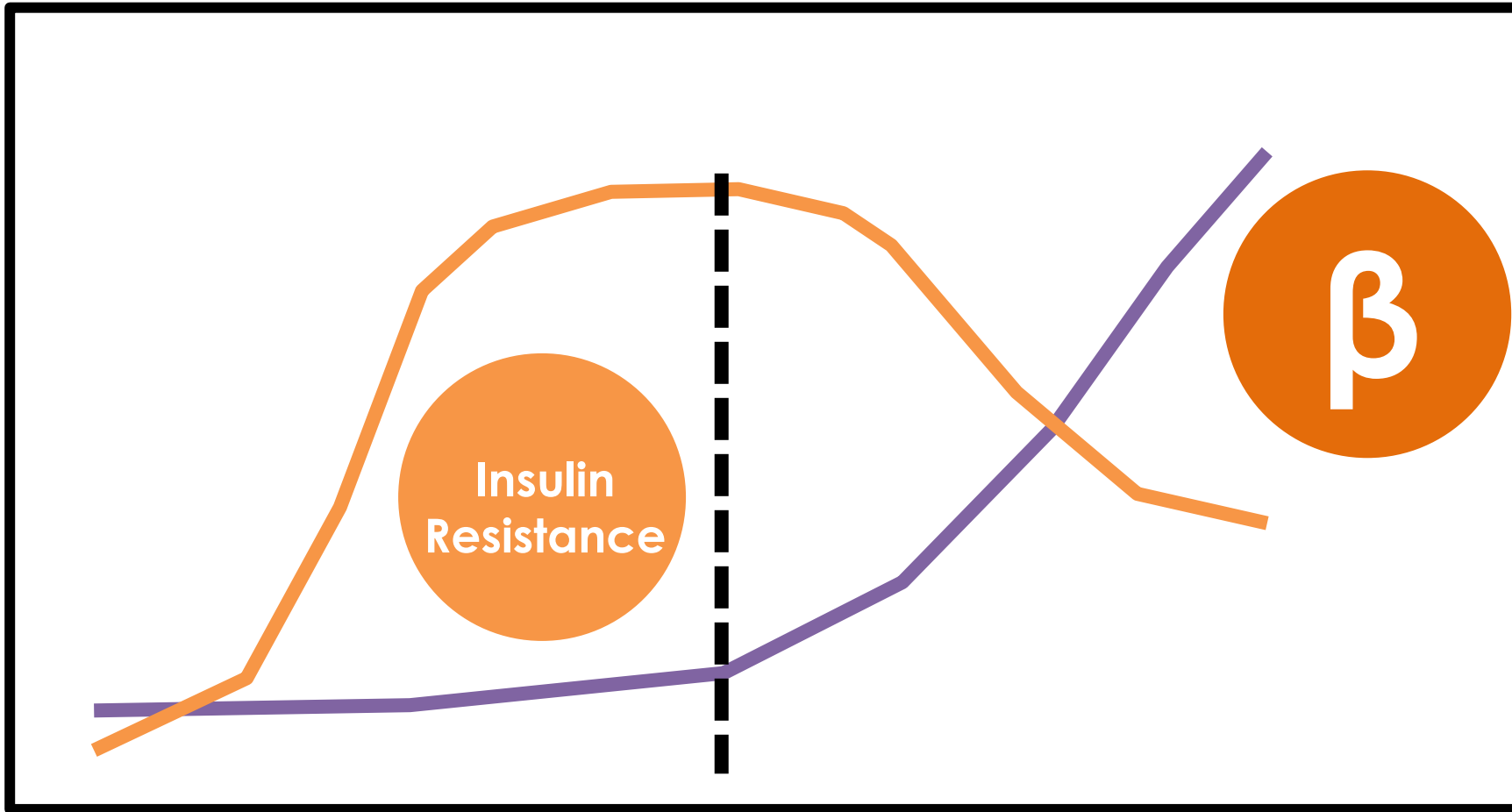
Type 2 Diabetes

2

Insulin
Resistance

β

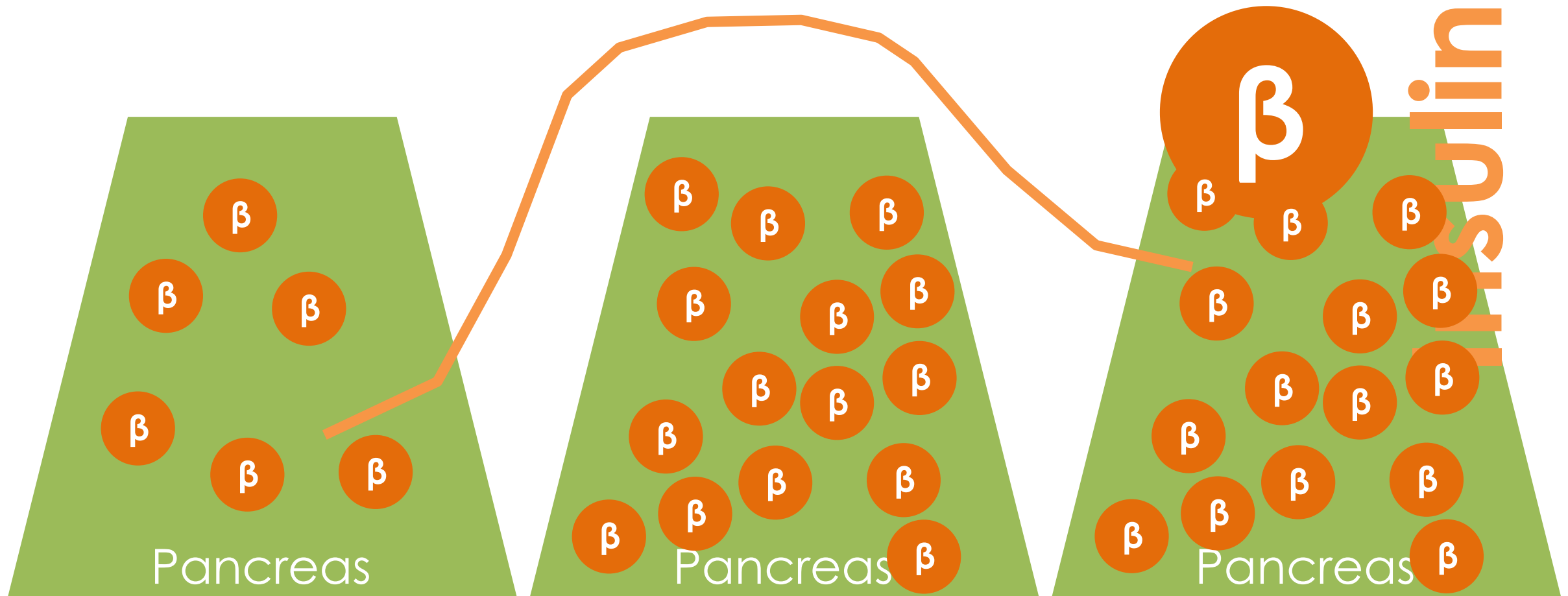
Glucose



Insulin

Time
(years)

“... islet cell mass is dynamic and capable of adapting to physiological or pathological conditions to maintain normoglycemia.”





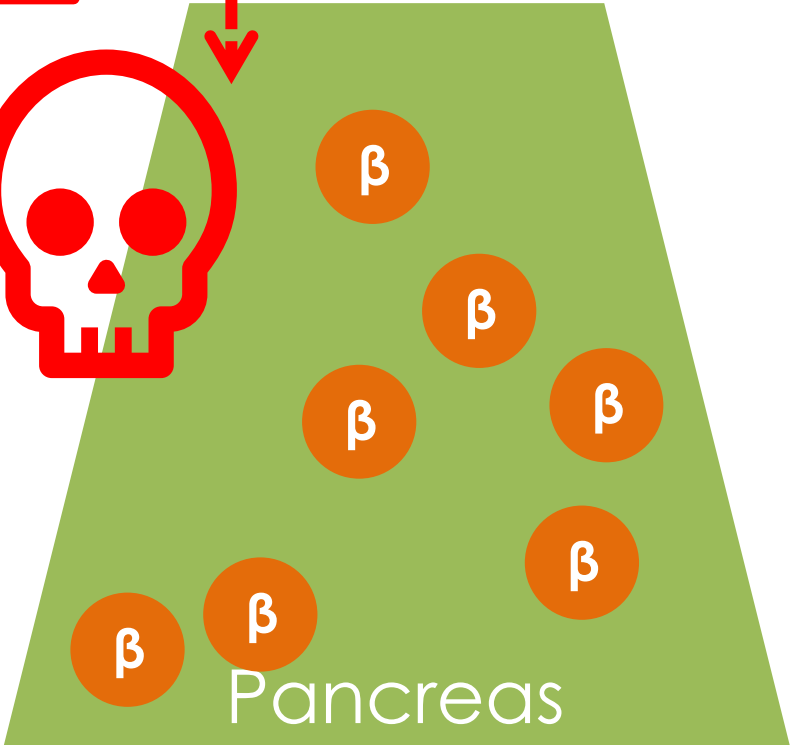
Why do they die?

Ceramides

Stress

Inflammation

Hyperinsulinemia



Pancreas



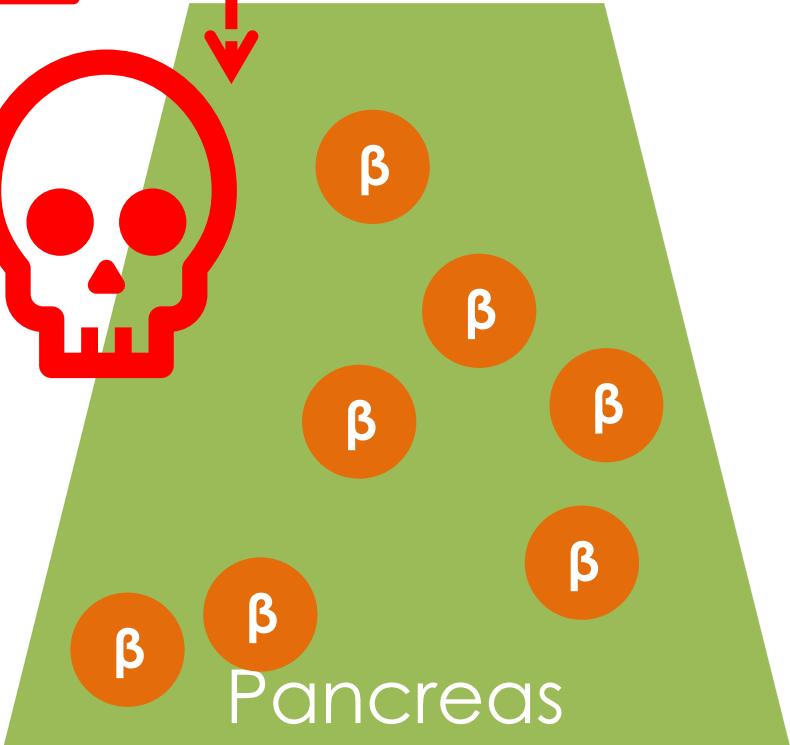
Can it be reversed?

Ceramides

Stress

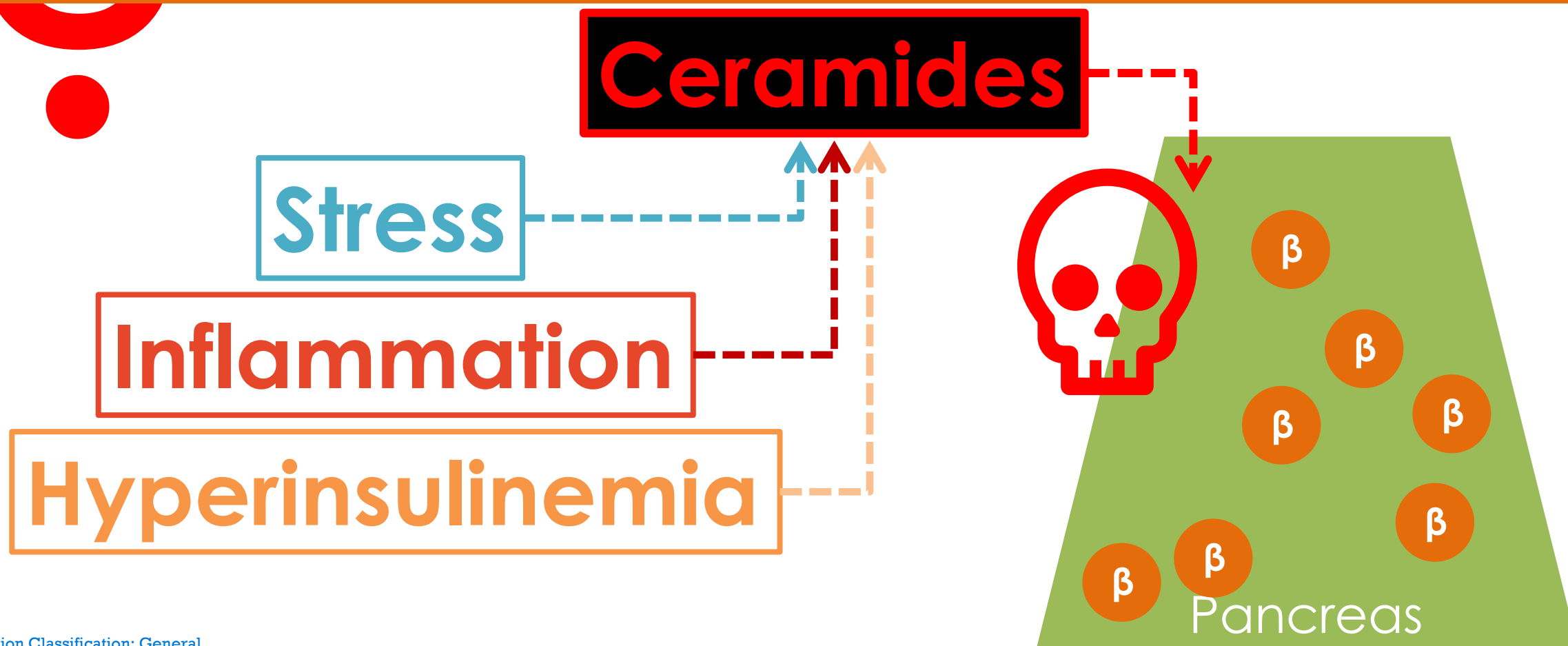
Inflammation

Hyperinsulinemia



Pancreas

“Remission of diabetes of variable duration can be achieved in T2D subjects by carbohydrate restriction and low-calorie diets ... Improved beta cell function has been described in most studies documenting diabetes remission.”





Diabetes



What is T2DM?

Insulin

How does it become T2DM?

Can it be reversed?

Diabetes

What is T1DM?

How does it become T2DM?

Can it be reversed?