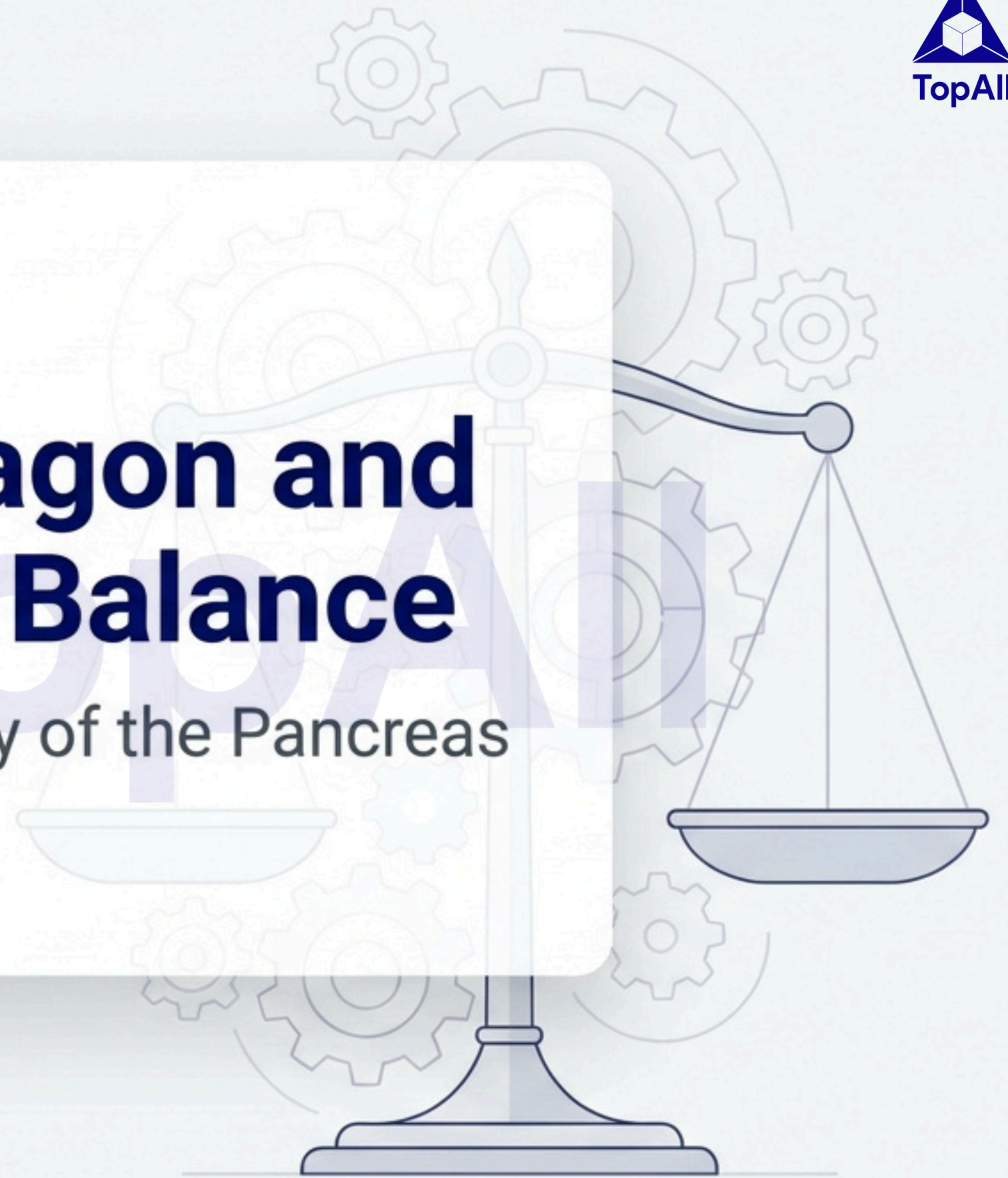


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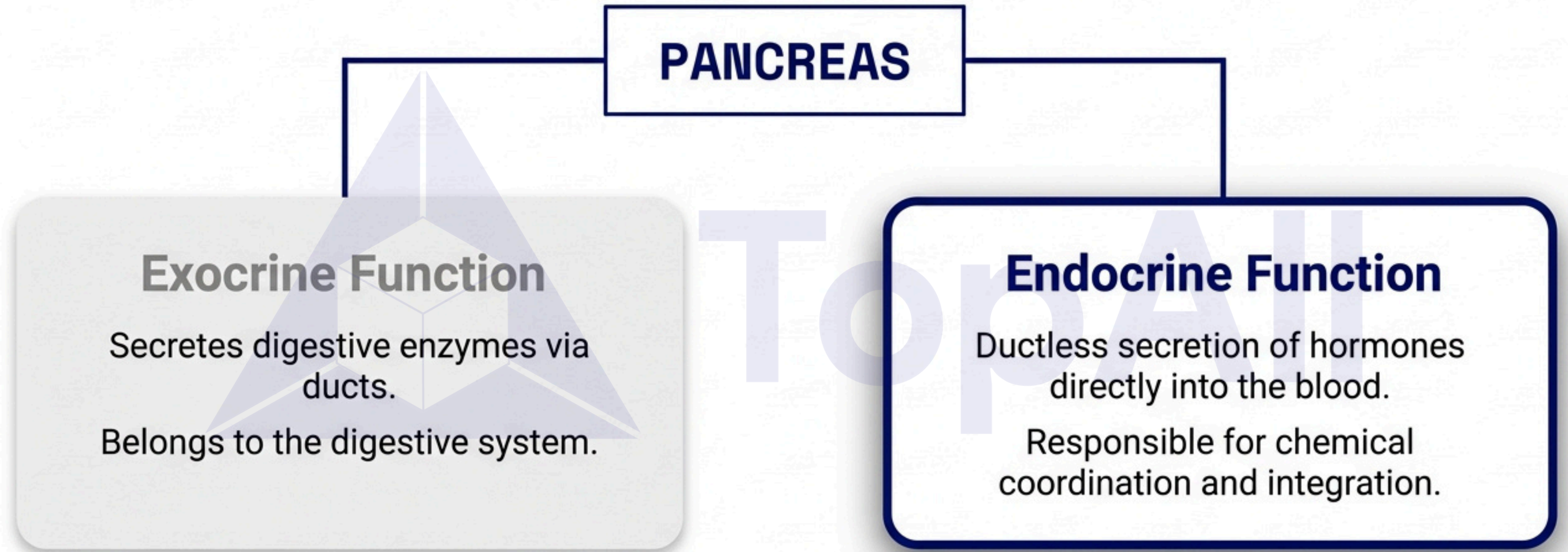
Insulin, Glucagon and Blood Sugar Balance

The Endocrine Physiology of the Pancreas



The Pancreas: A Composite Gland

PANCREAS



```
graph TD; A[PANCREAS] --> B[Exocrine Function]; A --> C[Endocrine Function];
```

Exocrine Function

Secretes digestive enzymes via ducts.

Belongs to the digestive system.

Endocrine Function

Ductless secretion of hormones directly into the blood.

Responsible for chemical coordination and integration.

While the exocrine pancreas handles digestion, the endocrine pancreas acts as the master regulator of blood glucose.

The Islets of Langerhans

**1 to 2
MILLION**

Total Islets in a normal human pancreas

1 to 2%

Fraction of total pancreatic tissue

The endocrine pancreas is entirely localized to these specialized micro-organs, scattered like tiny islands throughout the surrounding exocrine tissue.

Within these islands exist two primary types of cellular factories.



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Key Highlights

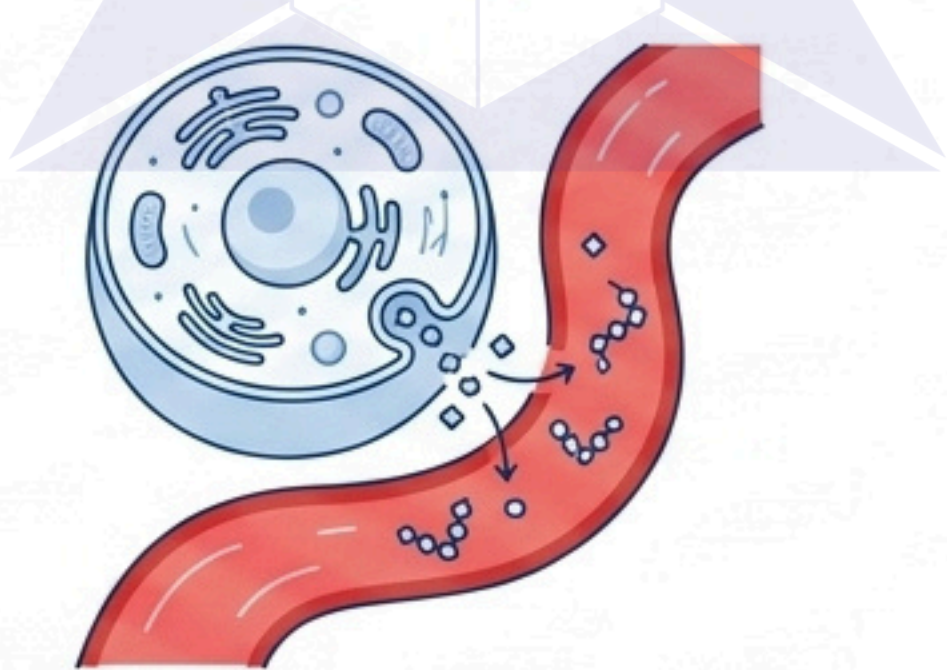
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α -cells: The Glucagon Factories

Profile/ID

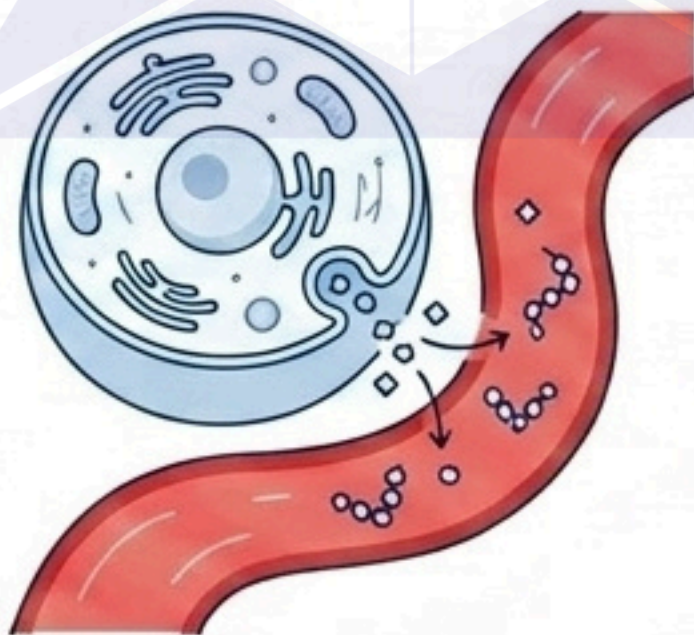
Cell Type:	α -cells (Alpha cells)
Key Output:	GLUCAGON
Nature:	Peptide Hormone
Primary Role:	To defend against dangerously low blood sugar levels.



β -cells: The Insulin Factories

Profile/ID

Cell Type:	β -cells (Beta cells)
Key Output:	INSULIN
Nature:	Peptide Hormone
Primary Role:	To regulate and rapidly clear high blood sugar levels.



Glucagon: The Hyperglycemic Pathway

Target

Acts mainly on hepatocytes (liver cells).

Action

Stimulates **GLYCOGENOLYSIS** (breakdown of glycogen) and **GLUCONEOGENESIS** (creation of new glucose). Reduces cellular glucose uptake and utilization.

Result

Increased blood sugar levels (**HYPERGLYCEMIA**)

Glucagon elevates blood sugar when the body needs energy, pulling glucose out of storage and into circulation.

Insulin: The Hypoglycemic Pathway

Target

Acts mainly on hepatocytes (liver cells) and adipocytes (fat tissues).



Action

Enhances cellular glucose uptake and utilization.
Stimulates **GLYCOGENESIS** (conversion of blood glucose into glycogen for storage).

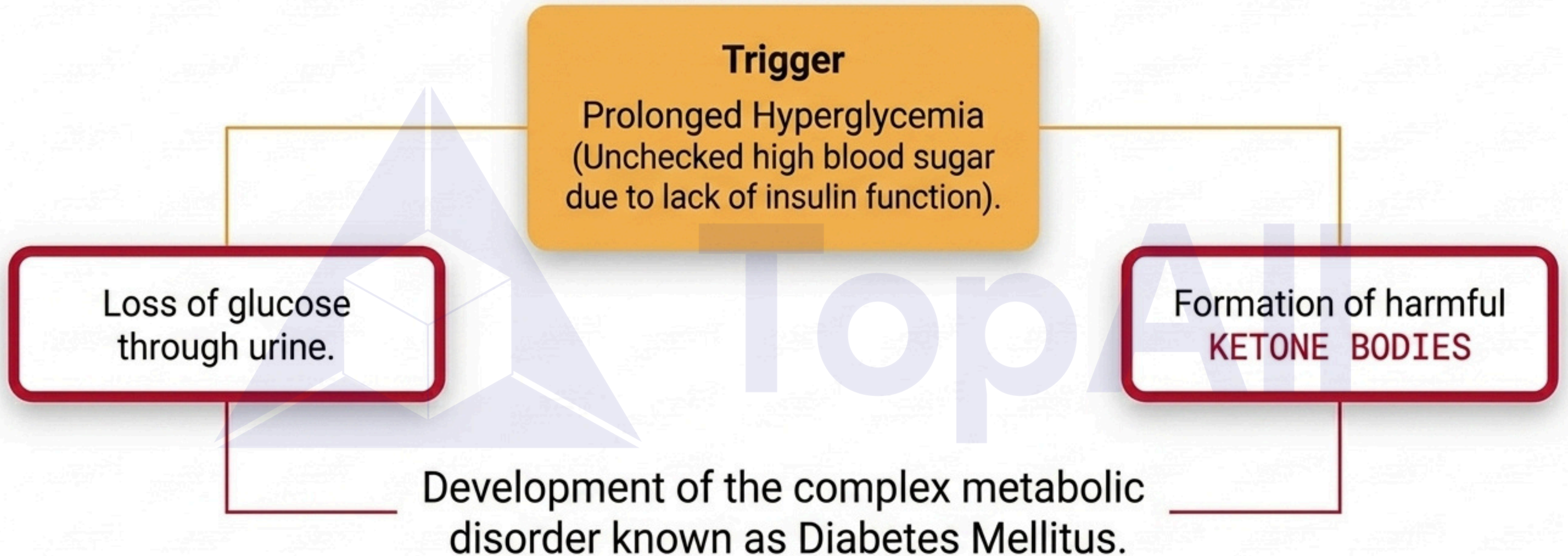


Result

Rapid movement of glucose from blood to cells, decreasing blood sugar (**HYPOGLYCEMIA**).

Insulin clears excess glucose from the blood, safely storing it and jointly maintaining homeostasis with glucagon.

System Failure: Diabetes Mellitus



Clinical Solution: Diabetic patients are successfully managed and treated with external **INSULIN** therapy to artificially restore the missing homeostasis.



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