

	Carbohydrate Metabolism:	Protein Metabolism:	Fat Metabolism:
GH	<ol style="list-style-type: none"> ↓ uptake and utilization of glucose by many insulin-sensitive cells ↑ synthesis of glucose by the liver → blood glucose concentration tends to rise and insulin secretion increases to compensate for the GH-induced insulin resistance .	<ol style="list-style-type: none"> ↑ amino acid uptake ↑ RNA translation ↑ transcription ↓ catabolism of protein and amino acids "protein sparer". → Increases muscle mass	<ol style="list-style-type: none"> ↑ lipolysis ↑ conversion of FFA to acetyl coenzyme A (utilization for energy) High GH levels → ketosis → fatty liver.
Thyroid hormone	<ol style="list-style-type: none"> ↑ glucose uptake by cells. ↑ glycogenolysis ↑ gluconeogenesis. ↑ Glucose absorption from the GIT. 	overall effect is catabolic leading to decrease in muscle mass .	<ol style="list-style-type: none"> ↑ lipolysis. ↓ plasma cholesterol by ↑ loss in feces. ↑ oxidation of free fatty acids.
Cortisol	<ol style="list-style-type: none"> ↓ glucose uptake and utilization by cells ↑ Gluconeogenesis ↑ Glycogen synthesis → insulin antagonist " adrenal diabetes "	In extrahepatic tissue: (catabolic) <ol style="list-style-type: none"> ↑ proteolysis ↑ amino acid release ↓ protein synthesis & stores ↓ amino acid uptake → ↑ amino acid levels in the blood In the liver: (anabolic) <ol style="list-style-type: none"> ↑ Amino acid uptake and degradation ↑ proteins and plasma protein 	<ol style="list-style-type: none"> ↑ Lipolysis ↑ FFA in blood ↑ utilization for energy ↑ Ketogenesis. deposition of fat in the thoracic and upper abdominal regions (buffalo hump and central obesity)
Epinephrine	In the liver: ↑ Glycogenolysis & gluconeogenesis In skeletal muscles: ↑ Glycogenolysis → can lead to hyperglycemia	In muscles: ↑ lactate and pyruvate release.	In adipose tissue: ↑ lipolysis → ↑ FFA and glycerol in blood
Insulin	In the liver: (+) glucose entry (+ GLUT2 transporters) (+) glycogen synthesis (↑ Glucokinase) (+) Glycolysis (-) gluconeogenesis (-) glycogenolysis (↓ phosphorylase). In muscles: (+) glucose entry (+ GLUT4 transporters) (+) glycogen synthesis In adipose tissue: (+) glucose entry (+ GLUT4 transporters)	In the liver: (+) protein synthesis In muscles: (+) amino acid uptake (+) protein synthesis in ribosomes (-) catabolism of protein (-) release of gluconeogenic AA	In the liver: (+) lipid synthesis (-) ketogenesis In muscles: (+) ketone uptake In adipose tissue: (+) glycerol phosphate synthesis (+) fatty acids synthesis (+) triglyceride deposition (+) lipoprotein lipase (for uptake of Chylomicrons and VLDL) (-) hormone-sensitive lipase = (-) lipolysis
Glucagon	(+) Glycogenolysis (+) Gluconeogenesis		(+) Lipid oxidation (fully to CO ₂ , or partially to produce ketone bodies).