Protien Metabolism	**Anabolic** - ↑ amino acids uptake & protein synthesis by tissues. - **Resulting in :** 1- Positive Nitrogen Balance 2- Decrease Blood level of Urea & amino acids	**Anabolic** **↑ Protein content in muscles & Liver by:** **1- Musles :** - ↑ amino acids uptake & protein synthesis by muscles. - ↓ protient catabolism & release of gluconeogenic amino acids **2- Liver :** ↑ protein synthesis in the liver as a result of suppression of gluconeogenesis. **Sparing effect of insulin:** Insulin provides an adequate supply of intracellular glucose available of oxidation & production of energy, that's way fats are stored in considerable amounts and proteins are spared to promote growth.	**Proteolytic** ↑ hepatic deamination of amino acids.	**Proteolytic** - ↑ protein catabolism - Negative nitrogen balance.	**Proteolytic** - ↑ protein catabolism resulting in increase blood level of AA. - **In Liver :** ↑ gluconeogenesis. - **In bone :** ↑ protein catabolism due to increasing the osteoclastic activity and results in : 1- osteoporosis or osteopenia. 2- Increase ca mobilization from bone and its excretion in urine.
Lipid Metabolism	**Lipolytic** - It mobilizes fat from adipose tissue. - Stimulate Lipolysis. - **Resulting in :** 1- ↓ body fat content. 2- ↑ blood level of FFAs & Keton bodies. **Protein sparing effect of GH:** 1- FFAs provide a source of energy for tissue → so protein spares → thus promoting protein synthesis (its growth effect) in hypoglycemia, fasting & stress 2- Main function in adults, not for growth but for maintenance of the tissue mass.	**Lipogenic** **1-**↑ lipogenesis in the liver & adipose tissue: - under effect of insulin → Liver glucose undergoes glycolysis & is transformed into fatty acids … **2- Prevents** lipolysis in fat cells, by inhibiting intracellular hormone-sensitive lipase enzyme. **3-**↓ ketogenesis in the liver AND ↑ keton bodies uptake by Sk.M.	**Lipolytic** ↑ lipolysis in adipose tissue.	**Lipolytic** **1- It lowers blood level of cholesterol by :** - ↑ formation of LDL receptors in liver, which favour hepatic removal of cholesterol from blood **2- It lowers blood level of lipid (although they stimulate lypolysis in adipose tissue) because :** - They simultaneously increase the metabolism of the fatty acids.	**Lipolytic** **1-↑ plasma level of FFAs, by:** - mobilizing fat from adipose tissue - ↓ hepatic lipogenesis. **2-** Affects the distribution of fat in he body (play role in adrenocortical hyperfunction)
Carbohydrate Metabolism	**Diabetogenic** (↑ blood glucose level) - ↑ hepatic glucose output. - ↑ glucose uptake by tissues (anti-insulin) through : 1- reduce tissue ability to bind it. 2- FFAs are readily available GH ↑ sensitivity of B cells & response to stimuli (glucose)……. SO, Admin. of GH initially cause temporary hypoglycemia BUT eventually cause hyperglycemia causes further release of insulin to promote growth (insulin in anabolic hormone).	**(Hypoglycemic)** 1- **Enhancing** facilitated diffusion of glucose into the cells. 2- **Enhancing** glucose entry into the liver cells. 3- ↑glycogen synthesis in muscles 4- ↓glucose output from the liver.	**(Hyperglycemic)** ↑ glucose output from the liver through stimulating : 1- Glycogenolysis. 2- Gluconeogenesis.	**Hyperglycemic** (after carbohydrate meal) ↑ the rate of carbohydrate absorption from GIT, thus blood glucose level ↑ after a carbohydrate meal BUT normally ↓ again rapidly because glucose utilization in the tissues also increases.	**Hyperglycemic** - **In Liver :** ↑ gluconeogenesis resuling in : 1- ↑ glycogenesis in liver 2- Hepatic glucose output - **At tissues :** ↓ glucose uptake (anti-insulin effect) except in brain and heart. Such effects lead to → hyperglycemia and may diabetes mellitus (adrenal diabetes) or worsen the diabetes if already present.
Electrolyte Metabolism	- ↑GIT absorption of Ca producing . - Producing +ve phosphorus balance. - ↓ rate of Na & K urinary excretion (used in growth)	**↓ the plasma level of K by :** Increasing k entry into the cells of the muscles & adipose tissue through activating the Na-K ATPase enzyme.		**Calcitonin (Ca-lowering hormone)** This hormone ↓ the plasma ca level through acting on : **1- The bone:** ↓ bone resorption through reducing the activity of osteoclasts. **2- Kidneys:** ↑ urinary excretion of ca by inhibiting its reabsorption from renal tubules.	**Mineralcorticoids** This hormone ↑ Na in ECF **AND** ECF volume by : 1- **Kidney:** acts on DCTs CTs , increasing Na reabsorpion in exchange with secretion of H & K 2- **Out side kidney:** increases Na absorption from body fluids than the urine (sweat) & GIT mucosa.
Calorigenic Effect	↑ the metabolic rate		↑ the metabolic rate, due to increase hepatic deamination of amino acids.	- ↑ metabolic rate & oxygen consumption in all tissues - Resulting in increase heat production & body temp. : 1- Partly due to ↑ metabolic rate of FFAs 2- Partly due to ↑ activity of membrane-bound Na-K ATPase	
M. OF Action			↑ cAMP	- **Calcitonin :** ↑ cAMP - **T3 &T4 :** activation of intracellular receptors (on nuclei)	**BOTH hormones act by :** activation of cytoplasmic intracellular receptors
Hormones	Growth Hormone	Insulin	Glucagon (hyperglucemic hormone)	T3 - T4	Glucocorticoids
Gland →	**Pituitary Gland**	**Pancreas**		**Thyroid Gland**	**Adrenal gland**