Carbohydrates

Sugars

Glucose forms 2 different types of rings when in solution

β-D Glucose 36% GLUCOSE OXIDASE ONLY RECOGNIZES THIS!

α-D Glucose 64%

Monosaccharaides:

Glucose-broken down starch

Galactose-dairy, sugar beets, jams, jelly

Fructose-fruits, honey

Mannose-plant polysaccharides not starch

Disaccharides

Maltose- Barley, Beer, cereals (glu+glu)

Lactose- Milk sugar (Glucose + Galactose)

Sucrose-table sugar, sugar cane, beets, maples (glucose + fructose)

Polysaccharides:

Starch- Plants

- Amyloses-shorter
- Amylopectin-longer and with branching chains

Glycogen- Animals

- Similar structure to amylopectin, more extensive branching

Relevant Hormones:

β Insulin- increases uptake by cells

Second messenger duties (stimulates lipogenesis, inhibits lipase, stimulates protein synthesis & AA transport, inhibits protein breakdown, stimulates glycogen synthesis, inhibits gluconeogenesis, simulates glucose transport)

4 cell types do not need insulin to take in glucose: Retina, RBCs, Kidney, Brain

α Glucagon- primary hormone responsible for raising blood glucose

Stimulates glycogenolysis and gluconeogenesis

Epinephrine- aka adrenaline catecholamine secreted by adrenal medulla, stimulates glucagon release

Cortisol- Secreted by adrenal cortex stimulates gluconeogenesis and glucagon release

Growth Hormone-Ant. Pituitary inhibits glucose uptake by cells

Thyroxine (T4)- least important stimulates glycogenolysis

δ Somatostatin- secreted by hypothalamus, GI tract and D-cells of pancreas Inhibits BOTH insulin and glucagon release

ACTH-secreted by the Ant. Pituitary, stimulates cortisol which stimulates gluconeogenesis and glucagon release, also acts as antagonist to insulin

Glucose Methods

Hexokinase (reference method)

$$\text{Glucose} + \text{ATP} \xrightarrow{\text{HK+Mg2+}} \text{Glucose} - 6 - \text{Phosphate} + \text{ADP}$$

$$\text{Glucose} - 6 - \text{phosphate} + \text{NADP} \xrightarrow{\text{G-6-PD}} 6 - \text{Phosphogluconate} + \text{NADPH}$$

Increase in absorbance at 340nm

Glucose Oxidase

$$\beta - \text{D Glucose} + \text{O2} \xrightarrow{\text{GO}} \text{Gluconic Acid} + \text{H2O2}$$

polarographic electrode measures O2 consumed in rxn (H2O2 can decompose back) so other rxns sequester the H2O2

Also may use chromogenic oxygen receptor, or dye that changes color in presence of H2O2

Trinder Reaction for H2O2

$$\mathrm{H2O2} + 4 - \mathrm{aminophenazone} + \mathrm{phenol} \xrightarrow{\mathrm{POD}} \mathrm{Quinone\ complex} + 2\ \mathrm{H2O}$$

Many interfering substances

Glucose Dehydrogenase

$$\beta - \mathrm{D\ Glucose} + \mathrm{NAD} + \xrightarrow{\mathrm{GDH}} \mathrm{D} - \mathrm{glucono}\ \delta\ \mathrm{lactone} + \mathrm{NADH} + \mathrm{H} +$$

Increase in abs. @ 340 nm