GLYCOGEN METABOLISM

OVERVIEW

- Glucose is greatly preferred energy source for brain and required energy source for cells with few or no mitochondria i.e. RBCs
- Glucose is the substrate for anaerobic glycolysis in an exercising muscle
- 3 sources to obtain blood glucose: the diet, glycogenolysis (degradation of glycogen into glucose) & gluconeogenesis (formation of glucose from non-carbohydrate sources)
- Dietary intake of glucose is sporadic, not always a reliable source of blood glucose
- Gluconeogenesis provide sustained synthesis of glucose, slow in responding to a falling blood glucose level
- For a falling blood glucose level, glycogenolysis is the most preferred source of glucose as glycogen can be rapidly mobilized from liver and kidney
- Muscle glycogen is extensively degraded in exercising muscle to provide the tissue with an important energy source
- Gluconeogenesis comes into play when glycogen stores are depleted

STRUCTURE AND FUNCTION OF GLYCOGEN

- Main stores of glycogen in: skeletal muscle and liver
- Function of muscle glycogen: fuel reserve for ATP synthesis during muscle contraction
- Function of liver glycogen: maintenance of blood glucose level, particularly during early stages of fast (for 10-18 hours)

Amounts of liver and muscle glycogen

- 1-2% of fresh weight of resting muscle ← 400g of glycogen
- 10% of fresh weight of well-fed adult liver ← 100g of glycogen
- Muscle mass is greater than liver muscle so most of the body’s glycogen is found in muscle

Structure of glycogen

- A branched chain polysaccharide made exclusively from α-D-glucose
- Primary glycosidic bond = α(1→4) linkage
- After 8-10 glucosyl residues, there is a branch containing an α(1→6) linkage
- Single glycogen molecule’s molecular weight = up to 10^8 Da
- Glycogen exist in discrete cytoplasmic granules

Fluctuation of glycogen stores

- Liver glycogen stores increase during well-fed state and are depleted during a fast
- Muscle glycogen not affected by short periods of fasting (few days), moderately decreased in prolonged fasting (weeks), depleted following strenuous exercise
- Glycogen synthesis and degradation go on continuously