Biochemistry 3070 Review Topics for Final Exam ***Dr. Walker***

Introduction to Metabolism: Vitamins & Coenzymes

Be familiar with the functions of fat-soluble vitamins A,D,E,K. What roles do vitamins play in biochemistry?
What diseases or conditions are prevented by specific vitamins? (thiamine, ascorbic acid, etc.)
Know the general structures (components) of CoA, FAD, ATP, NADH, NADPH

Glycolysis

Structures in pathway; glucose → pyruvate → lactic acid; names of compounds, types of enzymes
Know reactions where ATP, NADH, $C0_2$, 2,3-BPG are formed and/or released, and control points.
Fermentation, ethanol formation (fermentation), Proof Scale

TCA Cycle

Know structures, enzyme types, names of structures, where ATP (GTP), NADH, $FADH_2$, CO2 are formed & control points;
Follow ^{14}C-labled carbon atoms in structures around the cycle.

Oxidative Phosphorylation

Mitochondrial structure; Redox potentials (E'_o), electron transport chain, sites (1,2,3,4), e^- carriers
Identify where electrons enter pathway and flow through various carriers in pathway
Know inhibitors (blockers) of electron flow and specific sites (e.g., CN^-); uncouplers of ΔpH (2,4-DNP);
Proton flow blockers (oligomycin at CF_o); ATP accounting (e.g., 30 [or 32] ATP from glucose → CO_2+H_2O)
Malate vs. glycerol phosphate shuttles

Phosphate Shunt

Know names of sugars and number of carbon atoms in each; pathway generates NADPH, C_3, C_4, C_5, C_6, C_7 sugars
Transaldolase and transketolase (# of Carbons transferred by each enzyme)

Gluconeogenesis

Many reactions of glycolysis are reversible; know those that are not. Cori cycle: locations of gluconeogenesis
Biotin helps transfer activated CO_2 groups; e.g., pyruvate +CO_2 → oxaloacetate.

Glycogen Metabolism

Glycogen is a highly-efficient (~97%) storage form of glucose; glycogenesis vs. glucogenolysis; α-1,4 vs α-1,6 linkages
Glycogen phosphorylase releases glucose-1-phosphate from glycogen's non-reducing ends, utilizing inorganic phosphate.
De-branching requires a transferase and an α-1,6-glucosidase to hydrolytically remove a single remaining residue
Epinephirine & glucagon both trigger glycogenolysis via cAMP-stimulated enzymatic cascades of phosphorylase enzymes
Glycogenesis requires activation of glucose to UDP-glucose; a branching enzyme moves portions of chain upstream.
Insulin causes amplified inactivation of glycogen synthetase kinase, inactivating glycogen synthase and slowing glycogenesis.

Fatty Acid Metabolism

β-oxidation process; activation of fatty acids requires two ATP's to form acyl CoA
Know chemical structures of β-oxidation "cycle;" where FAD & NAD^+ are reduced; # cycles for C_{12}, C_{l4}, C_{l6}, C_{l8}- fatty acids.
ATP accounting for C_{12}, C_{14}, C_{16}, C_{18} fatty acids
Understand reactions for fatty acid biosynthesis; know differences (NADPH, ACP, locations) vs. β-oxidation.
Ketone bodies: reason for their formation and their identity; caused by fasting; clinical use in diagnosis of diabetes
Carntine required for fatty acyl CoA transport into mitochondria; Identify biotin's role in fatty acid synthesis

Photosynthesis

Thylakoid membranes within chloroplasts are the sites of photosynthesis
Chlorophylls (& other auxiliary pigments) absorb light energy and transfer it to reaction centers
Two separate light-driven reactions capture light energy: PSII &PSI;
PSII splits H_20 (using Mn in a variety of oxidation states) to form O_2, H^+ ions, & places electrons into pathway;
Herbicides Diuron & Atrazine inhibit PSII; e^-'s flow through membrane carriers to PSI, creating ΔpH;
PSI promotes electrons to ferredoxin, then forms NADPH
Cyclic flow of PSI yields ΔpH used to synthesize ATP; ATP is synthesized on the stromal surface of thylakoid membrane
ATP & NADPH are formed in "light" reactions & are used by the dark reactions (Calvin Cycle) to "fix" CO_2 and produce sugars.
The reactions of the Calvin Cycle are essentially a reversal of the Phosphate Shunt.
Germinating seeds can produce sugars from fatty acids due to a "short circuit" across the TCA cycle (the glyoxylate pathway).