

PHOTOSYNTHESIS

How Light energy is converted to ATP in plant chloroplasts (pigments, excitation and energy transfer)

Early experiments; Hill Reaction; Ochoa experiment; Ruben & Kamen; red-drop

Water is the source of the oxygen atoms in the O₂ produced by photosynthesis

Photosystems I (ferredoxin reduction) & II (water splitting); energetics, intermediates (PQ, PC, Fd)

Cytochrome B₆f complex; Q-cycle; Plastocyanin (PC) is reduced

NADPH Reductase

Organization of photosynthetic machinery in the thylakoid membrane

Stoichiometry 8 photons needed for 1 O₂

Energy for ATP synthesis; amount of ATP and NADH per O₂

Calvin Cycle (Know whole pathway, enzymes, intermediates, cofactors, and structures)

Clavin's experiment: 3PGA

3 stages (Rubisco, 3PGA → GA3P, generating Glc and RuBP)

RUBISCO: Mechanism (electron pushing)

Photorespiration- Rubisco oxygenase activity

Glycolate pathway (2 PGs gets converted to 1 PGA, plus CO₂)

Regulation of RUBISCO activity (pH, CO₂, Mg²⁺, NADPH)

Control of Photosynthesis (light, H⁺, and Mg²⁺ (F_d) reduction of disulfide due to light

C₃ vs C₄, why

GLUCONEOGENESIS (Know whole pathway, enzymes, intermediates, cofactors, and structures)

Reverse of glycolysis, 4 new enzymes and what they do

GLYCOGEN SYNTHESIS

PENTOSE PHOSPHATE PATHWAY (PPP) (Know whole pathway, enzymes, intermediates, cofactors, and struc.)

provides reduced electrons (NADPH) and Ribose 5-P

Oxidative Phase Generates NADPH and a Pentose; Malate-Aspartate Shuttle

Non-oxidative phase interconverts Rib 5-P to form Glc6P

Transketolase/transaldolase/transketolase

ROS

Glc 6-P Dehydrogenase deficiency

REGULATION OF CARBOHYDRATE METABOLISM

Know which enzymes in Catabolism vs Anabolism

Know how each is regulated; which are coordinated

ANAPLEROTIC REACTIONS, Pyruvate carboxylase, etc

Kornberg cycle: isocitrate lyase & malate synthase

circumvent the catabolic steps of TCA and yield succinate from 2 acetates

FATTY ACID BIOSYNTHESIS

Need acetyl-CoA, NADPH, ATP and carbohydrate; where they come from

Citrate used to bring acetyl-CoA to cytosol; Requires 2 ATP (pyruvate carboxylase and citrate lyase)

Malic enzyme provides another NADPH; pyruvate goes back in mitochondria

Acetyl-CoA Carboxylase (ACC) Reaction; makes malonyl-CoA

Fatty Acid Synthase (FAS); 4 steps, use of ACP

Compare & contrast with β-oxidation

Control of Fatty-acid synthesis

Synthesis: ACC; Allosteric (citrate & palmityl-Co) Glucagon → AMPK Insulin → PP2A

Degradation: carnitine transporter by malonyl-CoA

Diversification of Palmitate

Elongation; 2C units (malonyl-CoA); Essential (omega 3 & omega 6)

Desaturation; Fatty-acyl desaturase (oxidase); uses NADPH & O₂

Eicosanoids used to make PG, Tx, and LT

Precursors; EET, EPA, DHA, arachidonic acid (ARA)

COX-1 & COX-2; oxidase/peroxidase; inhibited by NSAIDs (aspirin)

Biosynthesis of Triacylglycerol (Fat)

Biosynthesis of membrane lipids