I. Overview
A. Photosynthesis (energy & CO₂ fixation) - chloroplasts
B. Respiratory & secondary metabolism
   1. Glycolysis - cytoplasm
   2. Krebs (Citric acid cycle) - mitochondrion
   3. Electron transport & oxidative phosphorylation - mitochondrion
II. Glycolysis [glucose and fructose via Calvin cycle (photosynthesis)]
   A. Glucose - glucose-6-p - fructose-6-p - fructose 1,6-dp - PGAL (=DHAP) - 1,3-dp-glycerate - 3-p-glycerate - 2-p-glycerate - phosphoenolpyruvate - pyruvate
   B. Initial step(s) - energy requiring (2 ATP)
   C. Subsequent steps
      1. Two - substrate-level phosphorylations (4 ATP)
      2. One - reduction of NAD to NADH (2 NADH)
   D. Yield - 2 ATP & 2 NADH
   E. Final product - 2 pyruvates
III. Alternatives after glycolysis
   A. Lactic acid - 2 ATP (no NADH) ... intense muscle activity (little O₂ available)
   B. Ethanol - 2 ATP (no NADH) ... fermentation
   C. Krebs Cycle - (2 ATP) and oxidative phosphorylation (32 ATP)
IV. Krebs Cycle - mitochondrial matrix
   B. Initial step(s) - pyruvate converted to acetyl CoA [CO₂ emission and NADH production] - acetyl CoA combines with oxaloacetate (4 carbon) to form citrate (6 carbon)
   C. All steps from pyruvate to CO₂
      1. Cycle (two trips) - 2 GTP (2 ATP), 8 NADH, and 2 FADH₂
   D. Final product - 6 CO₂
V. Electron transport system & Oxidative phosphorylation - inner mitochondrial membrane
   A. Convert NADH & FADH₂ to ATP
      1. NADH (glycolysis) = 2 ATP - 4 ATP
      2. NADH (Krebs) = 3 ATP - 24 ATP
      3. FADH₂ (Krebs) = 2 ATP - 4 ATP
   B. How is it done? H⁺ gradient (opposite of chloroplast)
      1. NADH & FADH₂ give up H⁺ to outer compartment (High outside)
      2. H⁺ is then pumped back in and ATP is produced
   C. Net yield of ATP
      1. From oxidative phosphorylation - 32 ATP
      2. Substrate level phosphorylation - 4 ATP
      3. TOTAL....................... 36 ATP
VI. Secondary metabolism
   A. From glycolysis & Krebs
      1. Fats, glycerol, fatty acids, amino acids, & proteins
         a) Example: Carbohydrate - (ribose) - nucleic acid
         b) Example: Amino acid - (glycine) - hemoglobin
         c) Example: Amino acid - (glutamate) - chlorophyll