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Friday, November 09, 2007
10:03 AM

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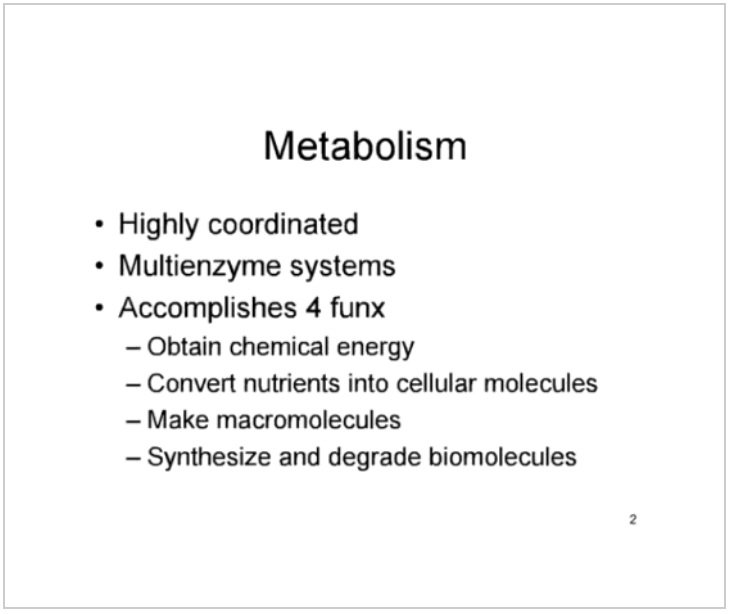
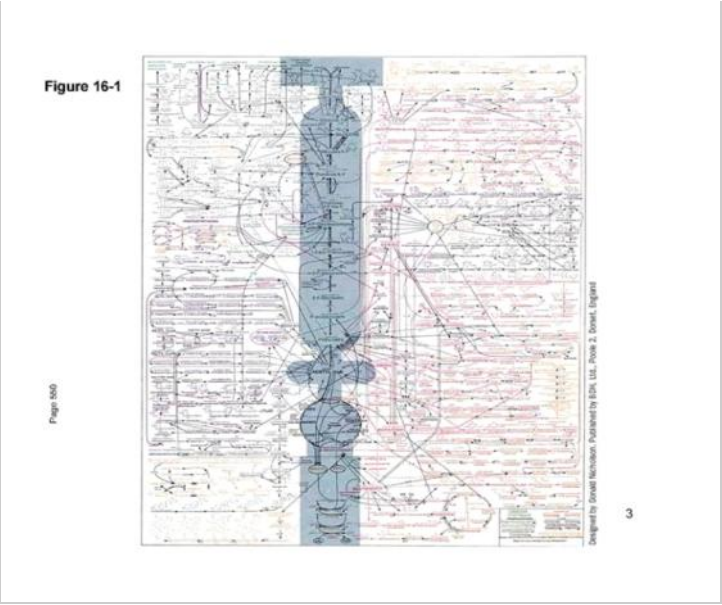
Audio recording started: 10:04 AM Friday, November 09, 2007

- Slide 1: Metabolism: introduction nov. 9, 2007

- Slide 2: metabolism
  - Highly coordinated
  - Multienzyme systems
  - Accomplishes 4 functions
    - Obtain chemical energy
      - Can come from glucose, solar energy
    - Convert nutrients into cellular molecules
      - If you have a protein source like beef or tofu, the amino acids can be broken down for energy
    - Make macromolecules
      - Example: glycogen, lipids, nucleic acids
    - Synthesize and degrade biomolecules
      - Degrade nutrients and synthesize molecules we need.
      - Examples: intracellular messenger, plant pigments, membrane lipids

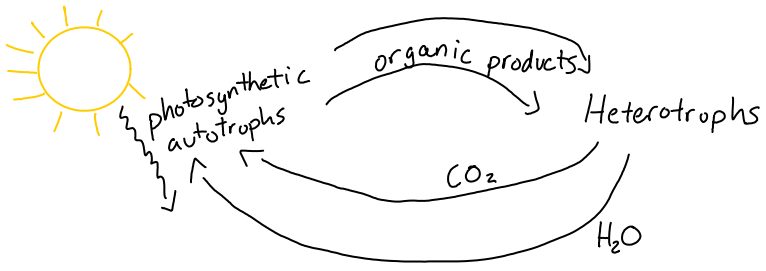


- Slide 3: Figure 16-1
  - Map of metabolic pathways.
  - Glycolysis is similar or identical among wide range of species



- Slide 4: Autotrophs and Heterotrophs
  - Autotrophs are self reliant (take CO_2 from atmosphere)
  - Heterotrphos derives carbon source from other organisms.

- Slide 5: Cycling of CO_2 and O_2 between autotrophs and heterotrophs



- Slide 6: metabolic pathways
  - Series of enzyme catalyzed reactions
  - Each step results in a specific, small chemical change
    - Removal, addition, or transfer of atom or functional group
  - Metabolites
    - Each step in metabolic pathways (metabolic intermediates)
  - 2 categories
    - Catabolic
    - Anabolic

Metabolic Pathways

- Series of enzyme catalyzed rxns
- Each step results in a specific, small chemical change
- Metabolites
- 2 Categories
  - Catabolic
  - anabolic

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- Slide 7: catabolism and anabolism
  - Catabolic pathways
    - Degradation
    - Complex molecules form simpler molecules
    - Exergonic
      - Negative ΔG
    - Free energy conserved in molecules
      - Energy released from reactions will be used in other pathways (can form ATP or NADH, FADH)

Catabolism & Anabolism

- Catabolic pathways
  - Degradation
  - Complex molecules --> simpler molecules
  - Exergonic
  - Free energy conserved in molecules
- Anabolic pathways
  - Simpler molecules-->complex molecules
  - endergonic
  - Uses energy rich molecules

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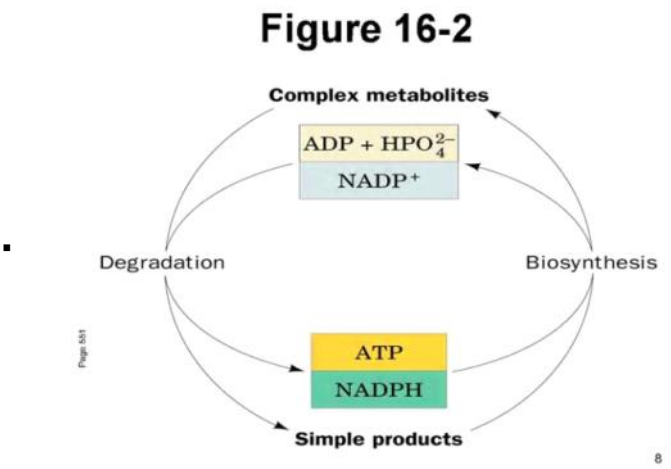
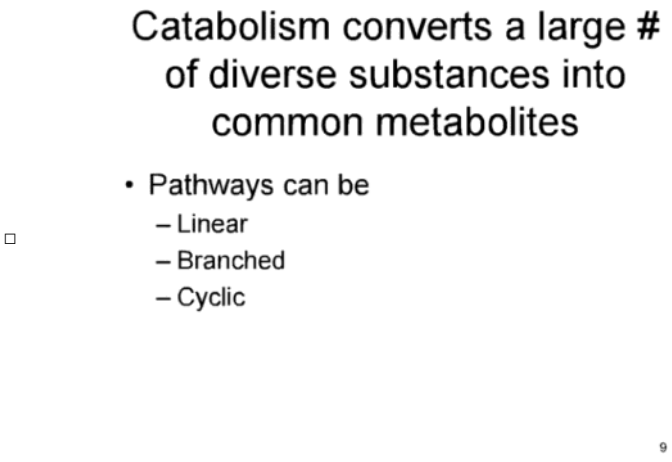
  - Anabolic pathways
    - Simpler molecules to more complex molecules
    - Endergonic
    - Uses energy rich molecules
      - ATP, FADH, NADH, etc are energy rich molecules

- Slide 8: Figure 16-2
  - Cycle between degradation and biosynthesis
    - Simple products: ATP, NADPH
    - Complex metabolites: ADP + HPO_4^{2-}

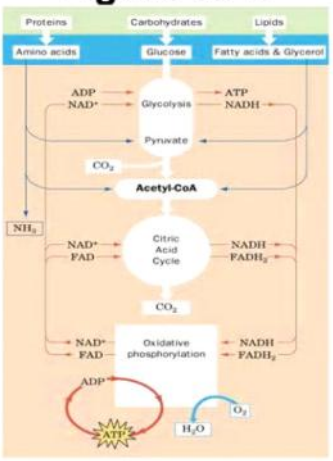


- Slide 9: Catabolism converts a large # of diverse substance into common metabolites
  - Pathways can be (applies to anabolism too)
    - Linear
    - Branched
      - A -> B + C
    - Cyclic
      - Citric acid cycle



- Slide 10: figure 16-3
  - Proteins broken into amino acids. Amino acids broken down to pyruvate or acetyl-CoA
  - Carbohydrates broken down to glucose in turn broken down for glycolysis then pyruvate… etc
  - Lipids broken down to fatty acids and glycerol to other pathways

- Figure 16-3



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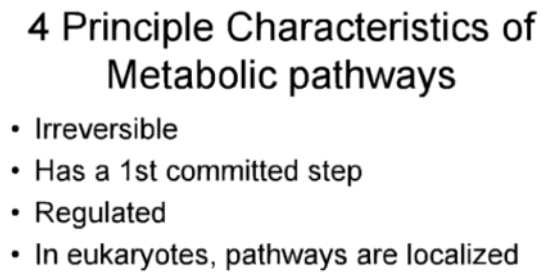
- Slide 11: 4 principle characteristics of metabolic pathways
  - Irreversible (in general)
    - Highly exergonic
  - Has a 1st committed step
    - Once A converts to B, then the whole pathway occurs and does not return to A
  - Regulated
    - Need to be regulated to conserve resources
  - In eukaryotes, pathways are localized



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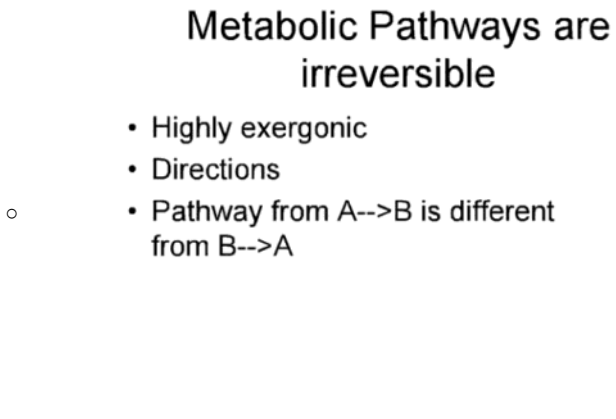
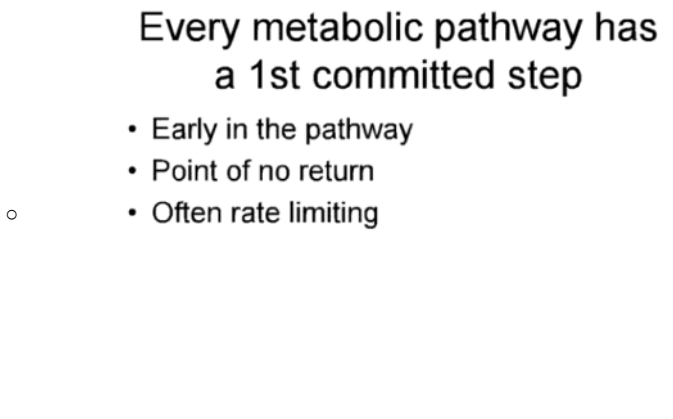
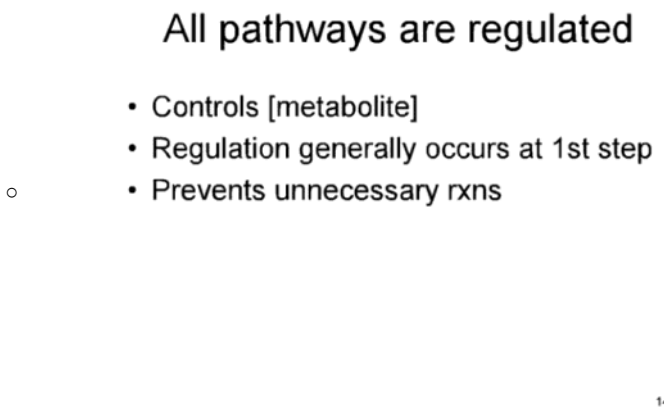
- Slide 12: Metabolic Pathways are irreversible
  - Highly exergonic pathways
  - Directions
    - Go in one direction
  - Pathways from a-B is different from pathway from B->A



- Slide 13: Every metabolic pathway has a 1st committed step
  - Early in the pathway
  - Point of no return
  - Often rate limiting



- Slide 14: All pathways are regulated
  - Controls [metabolite]
  - Regulation generally occurs at 1st step
  - Prevents unnecessary reactions



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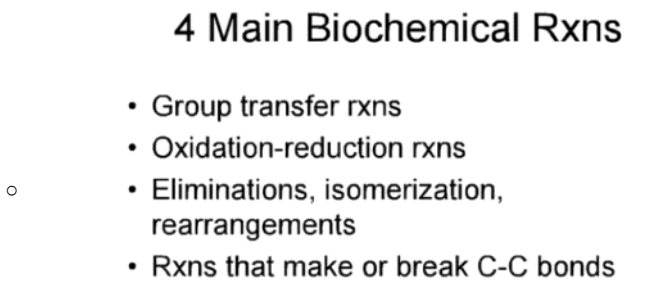
- Slide 15: 4 main biochemical reactions
  - Group transfer reactions
    - Hexokinase - transfers phosphate to glucose
  - Oxidation-reduction reactions
    - When we form NADPH from NAD is reduction
    - Breaking down glucose to CO_2 and H_2O is oxidation
  - Eliminations, isomerization, rearrangements
  - Reactions that make or break C-C bonds



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- Slide 16: Metabolic functions of eukaryotic organelles
  - Sub cellular localization to regulate metabolic pathways. Something like reactions in mitochondria has cytric acid cycle (creb's cycle). Oxidation phosphorilation and amino acid breakdown also in mitochondria
  - Gluconeogenisis occurs in cytosol
  - Lysosomes have enzymatic digestion of cellular components
  - Nucleus - DNA replication, transcription, RNA processing
  - Golgi - post translational modifications
    - Methylation, glycosolyation, etc
  - Rough E.R.
    - Where we have synthesis of proteins
  - Smooth E.R.
    - Where lipids and steroids are made
  - Peroxysomes
    - Oxidative reactions (won't go into it now)

Metabolic Funx of Eukaryotic Organelles

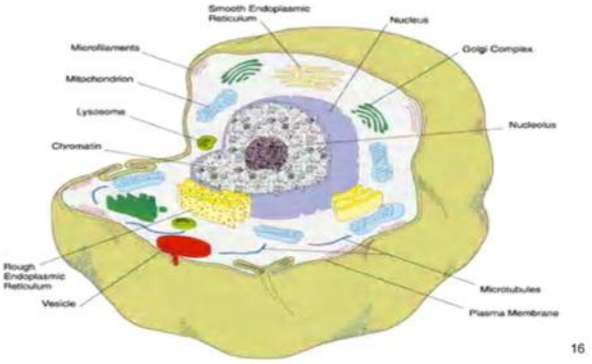

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Table 16-1

Organelle	Function
Mitochondrion	Citric acid cycle, electron transport and oxidative phosphorylation, fatty acid oxidation, amino acid breakdown
Cytosol	Glycolysis, pentose phosphate pathway, fatty acid biosynthesis, many reactions of gluconeogenesis
Lysosomes	Enzymatic digestion of cell components and ingested matter
Nucleus	DNA replication and transcription, RNA processing
Golgi apparatus	Posttranslational processing of membrane and secretory proteins; formation of plasma membrane and secretory vesicles
Rough endoplasmic reticulum	Synthesis of membrane-bound and secretory proteins
Smooth endoplasmic reticulum	Lipid and steroid biosynthesis
Peroxisomes (glyoxisomes in plants)	Oxidative reactions catalyzed by amino acid oxidases and catalase; glyoxylate cycle reactions in plants

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