



Audio Enhancement in Multimedia e-Learning

By Helen Cheung & Robert Ko



Student-Directed Learning Aids (SDLAs) in Biochemistry

- Facilitate understanding of abstract concepts in Biochemistry.
- Reinforcement of lecture materials.
- Emphasize integrative nature of biochemistry.
- Promote learning interests in biochemistry.

SDLA – BICH121 Introduction To Biochemistry

Structure of Biomolecules

Proteins

Introduction

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[Self Test](#)

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SDLA – BICH121 Introduction To Biochemistry

Structure of Biomolecules

Carbohydrates

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SDLA – BICH122 Intermediary Metabolism

Carbohydrate Metabolism **Glycolysis**

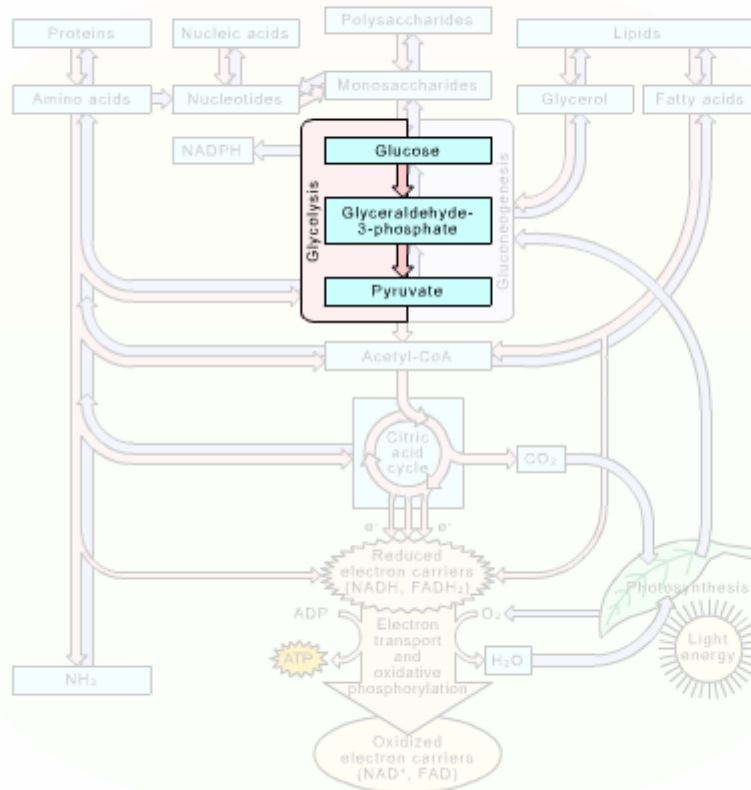
?

Introduction

Overview

Reaction
Details

Summary



Glycolysis is a central metabolic pathway involving metabolism of the sugar **glucose**. Glucose is usually derived from the energy storage polysaccharides (glycogen) or dietary carbohydrates. Reactions of glycolysis occur solely in the **cytosol** of the cells.

Self Quiz

SDLA – BICH122 Intermediary Metabolism

Carbohydrate Metabolism
Oxidative Decarboxylation and Citric Acid Cycle ?

Introduction **Overview** **Reaction Details of Oxidative Decarboxylation** **Reaction Details of Citric Acid Cycle** **Summary**

The diagram illustrates the metabolic pathways starting from macromolecules: Proteins (Amino acids), Nucleic acids (Nucleotides), Polysaccharides (Monosaccharides), and Lipids (Glycerol, Fatty acids). These feed into Glucose, which is converted to Glucose-3-phosphate and then Pyruvate via Glycolysis. Pyruvate is converted to Acetyl-CoA via Oxidative decarboxylation. Acetyl-CoA enters the Citric acid cycle, which releases CO₂ and provides electrons (e⁻) to reduced electron carriers (NADH, FADH₂). These carriers then undergo electron transport and oxidative phosphorylation to produce ATP and oxidized electron carriers (NAD⁺, FAD). The process also shows the integration with photosynthesis, which provides light energy and O₂ (which is used in oxidative phosphorylation to produce H₂O) and releases CO₂ (which is used in photosynthesis). NH₃ is also shown as a product of amino acid metabolism.

Relatively little potential energy stored in the glucose molecule is released by glycolysis. Far more energy is generated in the subsequent oxidative reactions, namely,

- Oxidative decarboxylation
- Oxidation of the acetyl-CoA in Citric acid cycle

The reactions occur within the matrix of mitochondria.

Self Quiz

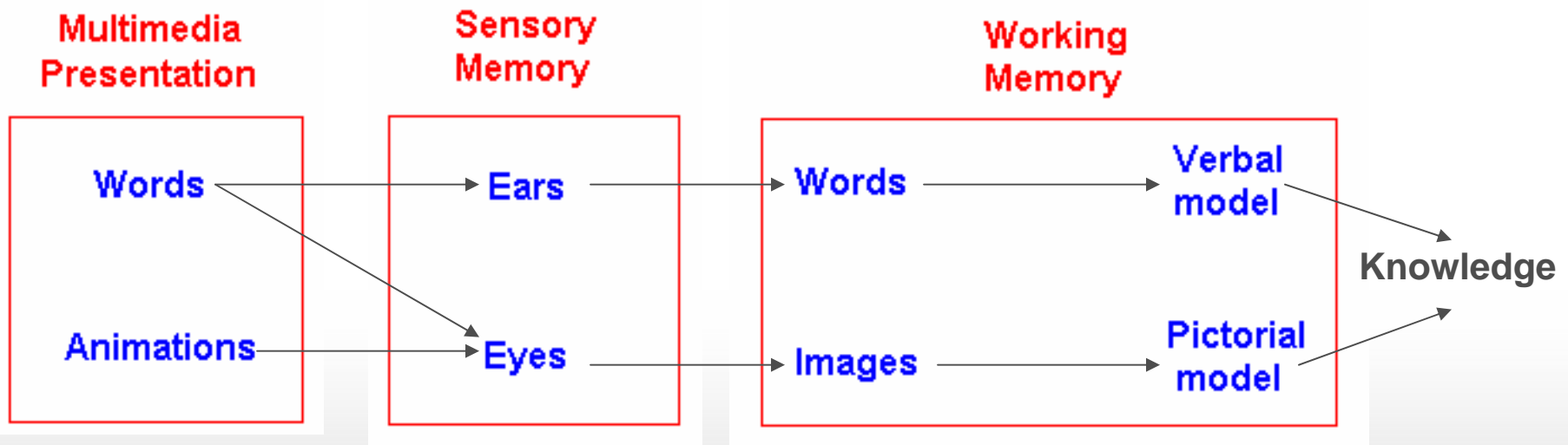


Audio Enhancement in Student-Directed Learning Aids (SDLAs) in Biochemistry

- To provide correct pronunciation of scientific terms.
- To prevent overloading of students' visual channel.
- To offer a choice of audio or visual transfer of information.

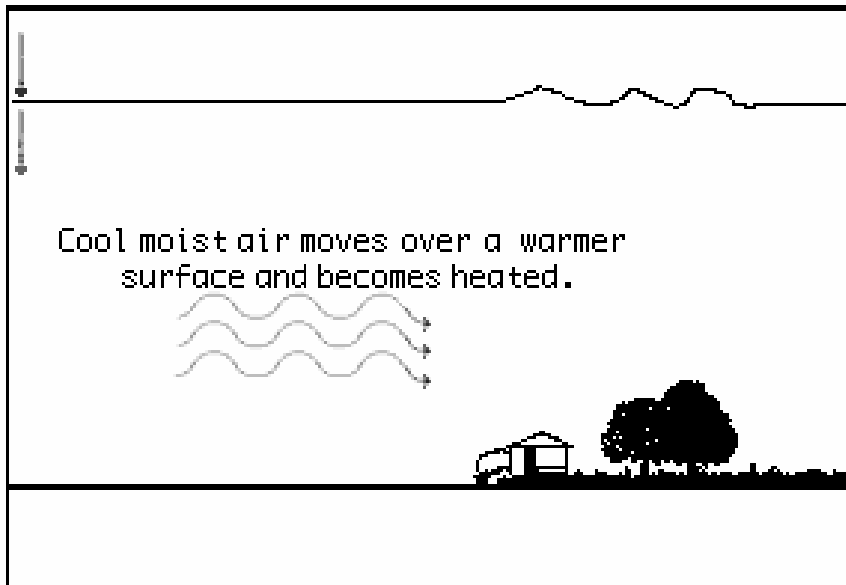


The Cognitive Theory of Multimedia Learning





Demo: The Cognitive Theory of Multimedia Learning

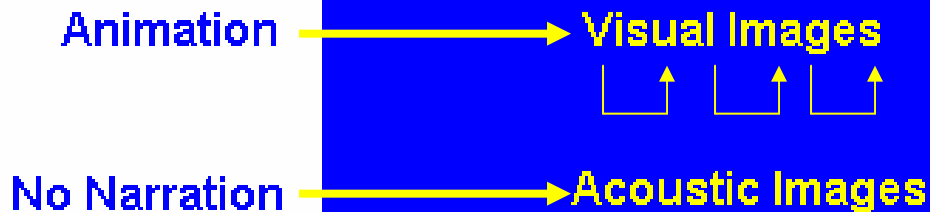
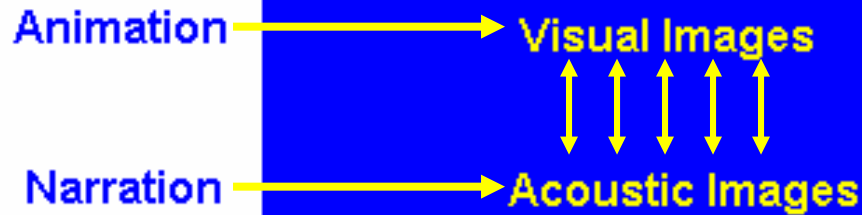


Demo A: Animation + Narration

Demo B: Animation + Text



Cognitive Overloading



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SDLA – BICH122 Intermediary Metabolism

Carbohydrate Metabolism Glycolysis

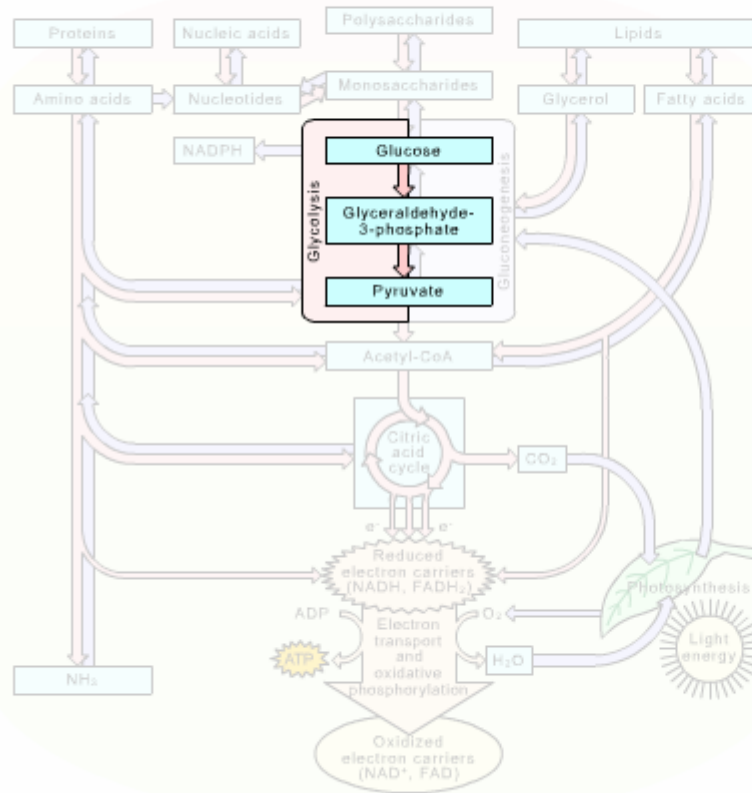


Introduction

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Glycolysis is a central metabolic pathway involving metabolism of the sugar **glucose**. Glucose is usually derived from the energy storage polysaccharides (glycogen) or dietary carbohydrates. Reactions of glycolysis occur solely in the **cytosol** of the cells.

Self Quiz

SDLA – BICH122 Intermediary Metabolism

Carbohydrate Metabolism
Oxidative Decarboxylation and Citric Acid Cycle ?

Introduction | Overview | Reaction Details of Oxidative Decarboxylation | Reaction Details of Citric Acid Cycle | Summary

The diagram illustrates the metabolic pathways starting from macromolecules: Proteins, Nucleic acids, Polysaccharides, and Lipids. Proteins are broken down into amino acids, which can be converted to pyruvate or enter the Citric Acid Cycle. Nucleic acids are broken down into nucleotides, which can be converted to glucose or enter the Citric Acid Cycle. Polysaccharides are broken down into monosaccharides, which are then converted to glucose. Lipids are broken down into glycerol and fatty acids, which can be converted to acetyl-CoA. Glucose is converted to glyceraldehyde-3-phosphate and then to pyruvate. Pyruvate is converted to acetyl-CoA. Acetyl-CoA enters the Citric Acid Cycle, which releases CO₂ and provides electrons (e⁻) to reduced electron carriers (NADH, FADH₂). These carriers then enter the electron transport and oxidative phosphorylation pathway, where O₂ is reduced to H₂O and ATP is produced from ADP. Light energy is used for photosynthesis, which produces O₂ and H₂O. NH₃ is also shown as a product of amino acid metabolism.

Relatively little potential energy stored in the glucose molecule is released by glycolysis. Far more energy is generated in the subsequent oxidative reactions, namely,

- Oxidative decarboxylation
- Oxidation of the acetyl-CoA in Citric acid cycle

The reactions occur within the **matrix of mitochondria**. (1)

Self Quiz



Follow-up Study: Evaluation of Audio Enhancement in SDLAs

- Frequency of use of the added audio function?
- Preference between text and narration?
- Overloading with simultaneous text, narration and animations on display?
- Convert permanent text into a display option?