

# Biology 10

Chapter 9-1, 9-3

p 250-253, 262-265

“Cellular Respiration: An Overview”, “Fermentation

## Objectives

- Explain what cellular respiration is.
- Describe what happens during the process of glycolysis.
- Name the two main types of fermentation.

## Chemical Energy and Food

- A single gram of glucose contains 3811 calories of energy.
  - **calorie:** \_\_\_\_\_
- A cell does not just “burn” a molecule of glucose, the energy released would destroy the cell!
- Instead, the glucose gets broken down in a series of reactions that release the energy a little bit at a time

## Electron Carriers used in Respiration

- Just like in photosynthesis, special molecules \_\_\_\_\_ capture high energy electrons and bring them to an electron transport chain
- The two electron carriers used in respiration are
  - \_\_\_\_\_ (nicotinamide adenine dinucleotide), provides enough energy to make \_\_\_\_\_
  - \_\_\_\_\_ (flavine adenine dinucleotide), provides enough energy to make \_\_\_\_\_

## Overview of Cellular Respiration

- There are three main phases of cellular respiration
  - \_\_\_\_\_:
  - \_\_\_\_\_ (covered in 9-2)
  - \_\_\_\_\_ (covered in 9-2)

Cellular Respiration Overview Image (see Fig 9-2, p252)

## Glycolysis

- Two major stages
- First stage
  - Two phosphate groups are added to glucose
  - the cell must \_\_\_\_\_ molecules for this step!
  - the glucose/phosphate is then \_\_\_\_\_ into two 3-carbon molecules of

**glyceraldehydes-3-phosphate** (\_\_\_\_\_)

## Glycolysis

### ■ Second stage

- each G3P has a hydrogen removed (\_\_\_\_\_)
- another phosphate molecule is added to each G3P, and the molecules are rearranged
- for each G3P, both phosphates are subsequently removed to \_\_\_\_\_ from ADP (\_\_\_\_\_ ATP total)

## Glycolysis

- \_\_\_\_\_ (= **pyruvic acid**) (3 carbon) is then formed
  - Note: 2 ATP invested, but 4 ATP given off! (\_\_\_\_\_)
- **Products: 2 pyruvate (which goes on to the next step), 2 NADH (which enter the electron transport chain), 2 ATP**
  - \_\_\_\_\_ for glycolysis, so can be used in anaerobic conditions if necessary
  - In anaerobic respiration, pyruvate is converted to either \_\_\_\_\_ and carbon dioxide, or \_\_\_\_\_, depending on organism (see above)

## Glycolysis Image

## Fermentation

- Glycolysis is the only part of cellular respiration that does NOT require \_\_\_\_\_!
- For organisms that are \_\_\_\_\_ (can't tolerate oxygen), glycolysis is the only way they can generate ATP
- If there is no oxygen present, organisms need to be able to regenerate the \_\_\_\_\_ to make glycolysis continue
- To regenerate NAD, organisms use \_\_\_\_\_

## Alcoholic Fermentation

- Used \_\_\_\_\_ and other microorganisms
- In alcoholic fermentation, the pyruvic acid is combined with the NADH formed in glycolysis
  - This regenerates the \_\_\_\_\_ needed for glycolysis
  - The other product is \_\_\_\_\_

## Lactic Acid Fermentation

- In other organisms (including humans) \_\_\_\_\_ **fermentation** is used
- Essentially a similar process as alcoholic fermentation, but the products of this process

- are NAD<sup>+</sup> and \_\_\_\_\_
- Lactic acid builds up in \_\_\_\_\_ that are overworked, which causes them to ache (“feel the burn”)
  - After exercise is done, you continue to breathe heavily to break down the lactic acid (= \_\_\_\_\_)

## Glycolysis Summary

- Inputs: 1 glucose, 2 ATP, 2 NAD, 2 inorganic phosphate
- Outputs: \_\_\_\_\_