

A photograph of three penguins walking on a sandy beach. The penguins are black on top and white on the bottom, with a distinctive yellow stripe on their heads. They are walking from left to right. The background is a blurred beach scene with waves in the distance.

# ***Biology: Life on Earth***

**Eighth Edition**

**Lecture for Chapter 6**

**Energy Flow in the Life of a Cell**

## Section 6.3 Outline

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- **6.3 How Is Cellular Energy Carried Between Coupled Reactions?**
  - Energy Carrier Molecules
  - ATP Is the Principal Energy Carrier in Cells
  - Electron Carriers Also Transport Energy Within Cells

# Energy Carrier Molecules

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- Food energy cannot be used directly to power energy-requiring reactions (e.g. muscle contraction)

# Energy Carrier Molecules

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- Energy carrier molecules act as intermediates to carry energy between exergonic and endergonic reactions
- Energy carrier molecules are only used *within* cells because they are unstable

# ATP

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- **Adenosine triphosphate (ATP)** is the most common energy carrying molecule
- ATP is composed of an adenosine molecule and three phosphates

<p><b>(a) Adenosine diphosphate (ADP)</b></p> <p>adenine</p> <p>ribose</p> <p>"high-energy" bond</p> <p>phosphate groups</p>	<p><b>(b) Adenosine triphosphate (ATP)</b></p> <p>adenine</p> <p>ribose</p> <p>"high-energy" bonds</p> <p>phosphate groups</p>
<p><b>Shorthand representations</b></p> <p>ADP</p>	<p><b>Shorthand representations</b></p> <p>ATP</p>
<p><b>Energy content</b></p> <p>low</p>	<p><b>Energy content</b></p> <p>high</p>

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# ATP

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- Energy is stored in the high-energy bond extending to the last phosphate
- Heat is given off when ATP breaks into ADP (adenosine diphosphate) and P (phosphate)

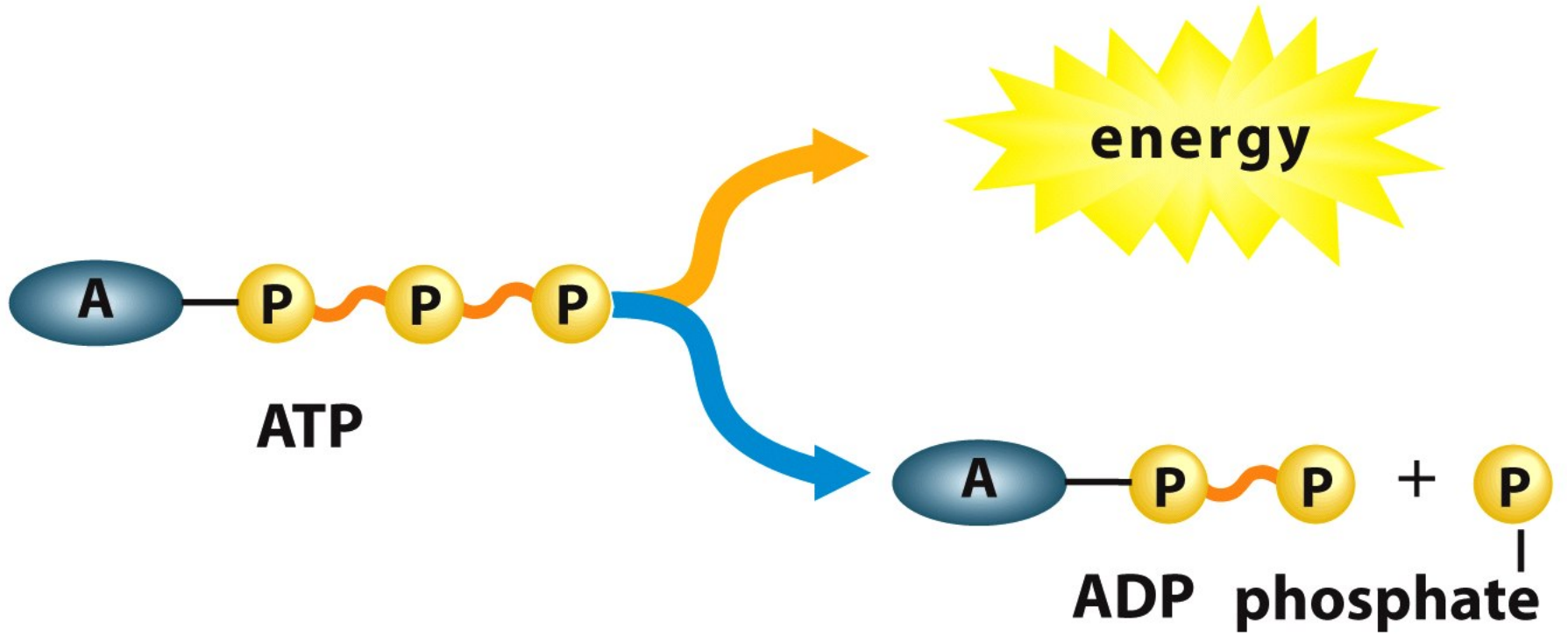


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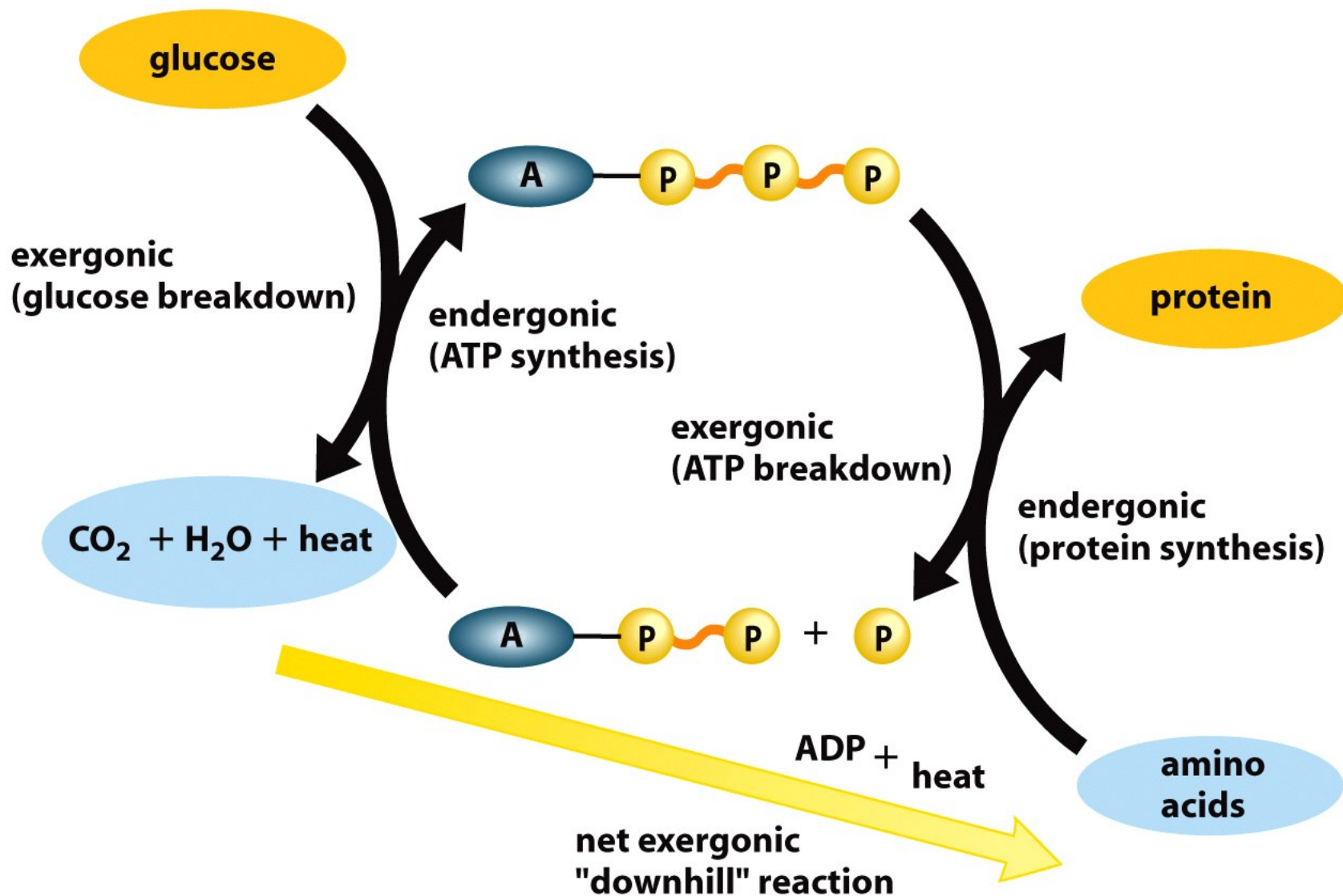


# ATP

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- The energy released when ATP is broken down into ADP + P is transferred to endergonic reactions through coupling

# Coupled reaction: glucose breakdown and protein synthesis



# Electron Carriers

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- Energy can be transferred to electrons in glucose metabolism and photosynthesis
- **Electron carriers** transport high-energy electrons

# Electron Carriers

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- Two common electron carriers
  1. Nicotinamide adenine dinucleotide (***NAD***<sup>+</sup>)
  2. Flavin adenine dinucleotide (***FAD***)

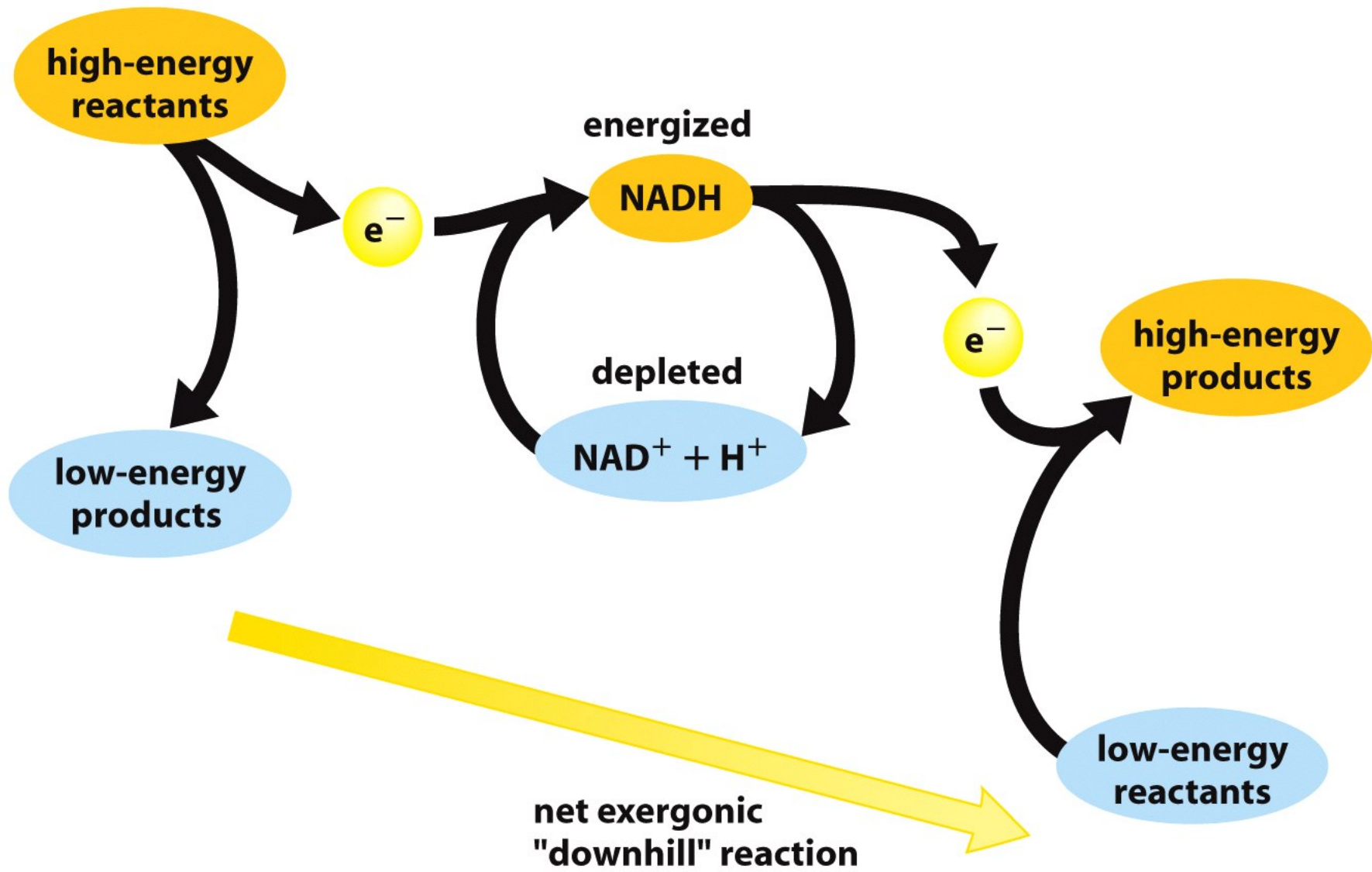


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