Chapter 6 – Dietary Energy and Cellular Respiration

The Sitting Disease: Understanding the causes and consequences of obesity

Driving Questions
1. How is obesity defined, and what are some hypotheses proposed to explain current obesity rates?
2. How does the body use the energy in food?
3. How does aerobic respiration extract useful energy from food?
4. When does fermentation occur, and why can’t a human survive strictly on fermentation?

Story Summary
Around the world, people are getting heavier, leading many to refer to an “obesity epidemic.” Whether overeating, decreases in physical activity, or both are responsible for this situation is hotly debated. This new story uses non-exercise activity thermogenesis (NEAT) to teach about Calorie balance, and the perhaps surprising contribution of everyday activities to Calorie expenditure. NEAT is the energy expenditure associated with everyday activities, such as walking the dog, cleaning the house — even fidgeting. The research of Dr. James Levine, an obesity expert at the Mayo Clinic (Phoenix) and Arizona State University, is featured in this story. His work has examined resistance to fat gain in overfed participants, and has found that people with higher levels of NEAT are more resistant to fat gain than people with lower levels of NEAT. The student is asked to consider what differences in NEAT and other forms of activity among people might have to do with our expanding waistlines.

Core science includes:
- How energy is stored in food and in the body
- ATP
- Aerobic respiration
- Fermentation
- Relationship between photosynthesis and aerobic respiration

Science for a changing world (story-specific science) includes:
- BMI and obesity rates
- Balancing Caloric intake and output
- Evidence that NEAT activities reduce fat gain and obesity

For additional information:
- NOVA’s Secret Life of Scientists and Engineers (2014), James Levine: “I Came Alive as a Person”: https://www.youtube.com/watch?v=flGgf0BO4tw