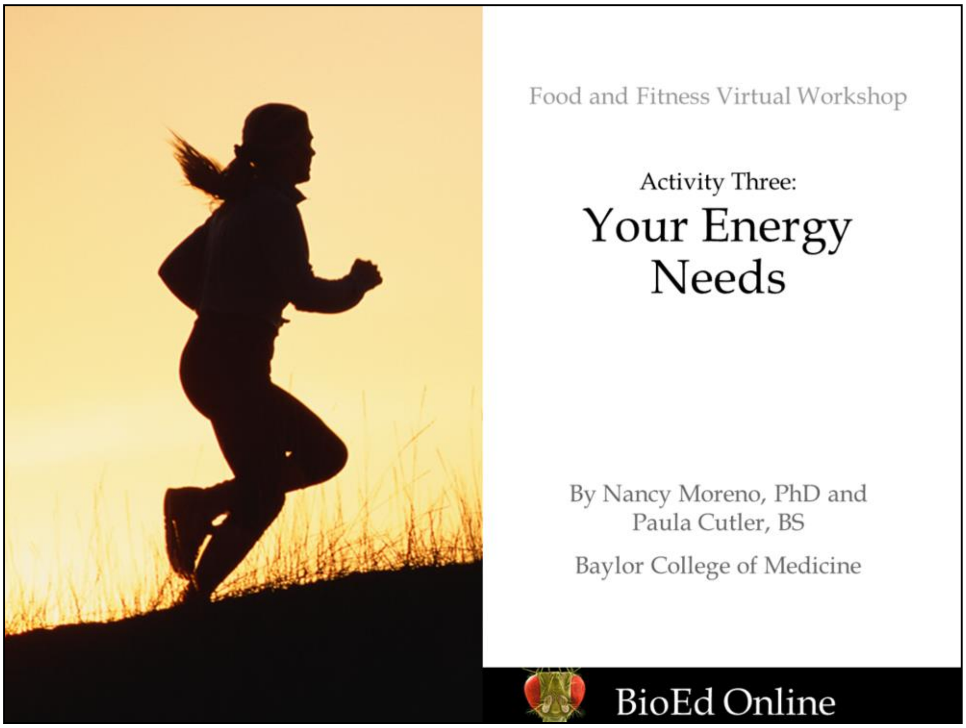



**Virtual Workshop: Food and Fitness (Activity Three) - Your Energy Needs**

Activity Three: Energy Sources, of the instructional unit, Food and Fitness, teaches students about how calorie and energy needs vary, depending on activity levels.

Science concepts covered in this activity include the following.

- All organisms need energy for their activities.
- Food is the only energy source for people and other animals.
- People's energy needs depend on body composition and level of activity, and correlate directly with fitness.
- Regular exercise is important to maintain and improve health.

The complete Food and Fitness Activities Guide for Teachers may be downloaded as a PDF file from the Teacher Resources menu on BioEd Online. <http://www.bioedonline.org/resources/nsbri.cfm>

Viewing this presentation fulfills part of the requirements for completing the Virtual Workshop on Energy, Food and Nutrition ("Food and Fitness"), offered for professional development contact hours on BioEd Online.

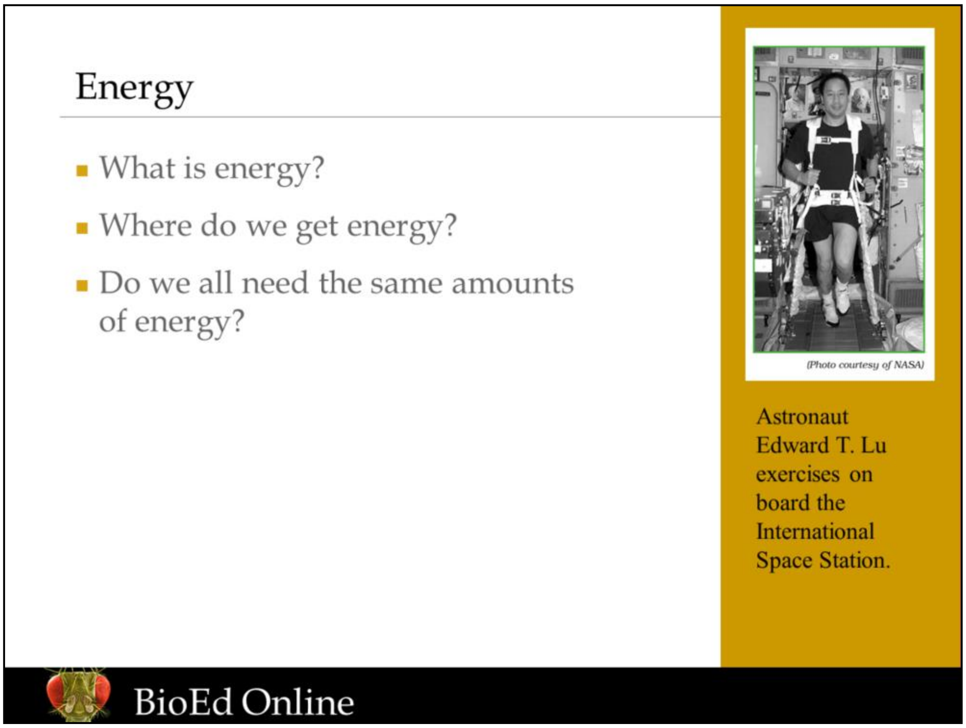
Funding for development of the Food and Fitness unit and accompanying online professional development was provided by the National Space Biomedical Research Institute (NSBRI), a consortium of leading biomedical research centers funded by the National Aeronautics and

Space Administration (NASA). Visit the following sites for more information about these organizations.

Center for Educational Outreach, Baylor College of Medicine: <http://www.ccit.bcm.tmc.edu/ceo/>

National Space Biomedical Research Institute: <www.nsbri.org>

National Aeronautics and Space Administration: <http://www.nasa.gov>




**Energy**

Energy fuels growth, movement and all the processes inside every cell inside the body. Energy itself can be thought of as the ability to do work (including movement). We obtain the energy we need from food, which is broken down inside our bodies and within individual cells.

Metabolism refers to all the chemical reactions inside a living organism. In addition to making energy available for use in cells, metabolism releases small amounts of heat (as observed in the yeast cultures in Activity One).

Not every person needs the same amount of food. Our energy needs depend on a number of factors, including body size, age, gender and level of physical activity.

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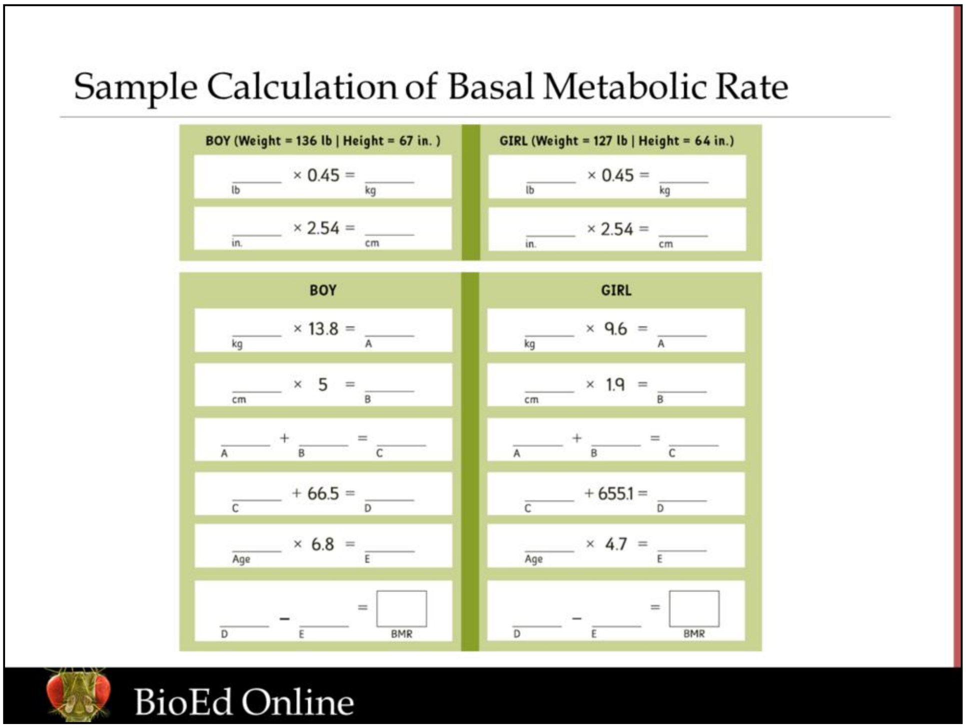



**Sample Calculation of Basal Metabolic Rate**

Basal Metabolic Rate (BMR) is the amount of calories needed by a person at rest. Specifically, BMR accounts for minimal levels of calories expended by the heart, liver, kidneys, brain, and muscle mass. BMR estimates are based on gender, age, height and weight. The calculations given above and in the Food and Fitness Guide for Teachers are made using an algorithm devised by Francis Benedict. He developed a set of equations that could estimate BMR in humans without complex measurements. The Harris-Benedict equations, given below, continue to be among the most common methods for calculating BMR.

For men, BMR = 66.5 + (13.75 x Weight) + (5.003 x Height) - (6.775 x Age).
For women, BMR = 655.1 + (9.5663 x Weight) + (1.85 x Height) - (4.676 x Age).

A more accurate method of estimating metabolic rate measures a subject’s oxygen intake per unit time, and takes into consideration the oxygen content of both inspired air (breathed in) and expired air (breathed out).

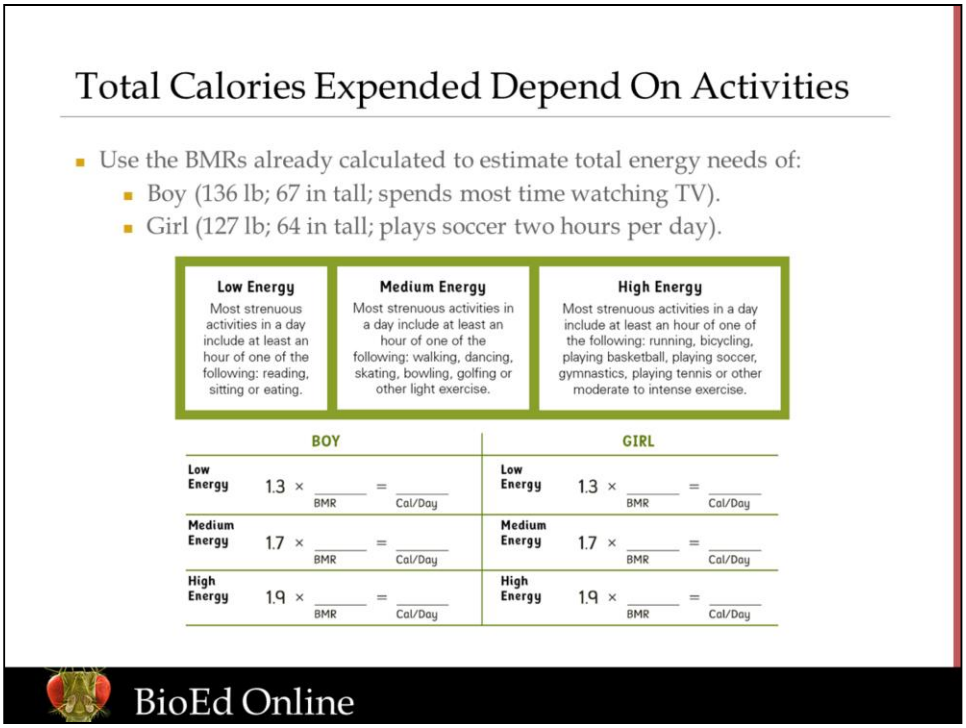
For the sample data given, the BMR is 1668 Calories per day for the boy and 1447 Calories per day for the girl.

The complete Food and Fitness Activities Guide for Teachers may be downloaded as a PDF file from the Teacher Resources menu on BioEd Online. <http://www.bioedonline.org/resources/nsbri.cfm>

References:

Harris, J., & Benedict, F. (1919). *A biometric study of basal metabolism in man*. Washington D.C.: Carnegie Institute of Washington.

Vander, A., Sherman, J., & Luciano, D. (1998). *Human Physiology: The Mechanisms of Body Function* (7th ed.). Boston: WCB McGraw-Hill.




**Total Calories Expended Depend On Activities**

Resting energy needs (basal metabolic rate - BMR), account for only part of the Calories expended by the body. Physical activities also require energy. An individual's total energy expenditure consists of energy used at rest and during physical activity. Both the kind of activity and the length of time during which it is performed influence the amount of energy used. Calories that are not used for resting metabolisms or to fuel activities are stored as fat. Thus, to maintain a constant weight, calories taken in from food should equal calories expended.

In this example for students, the active girl uses more Calories per day (2,749 Calories) than does the sedentary boy (2,168 Calories), even though the boy's BMR is higher.

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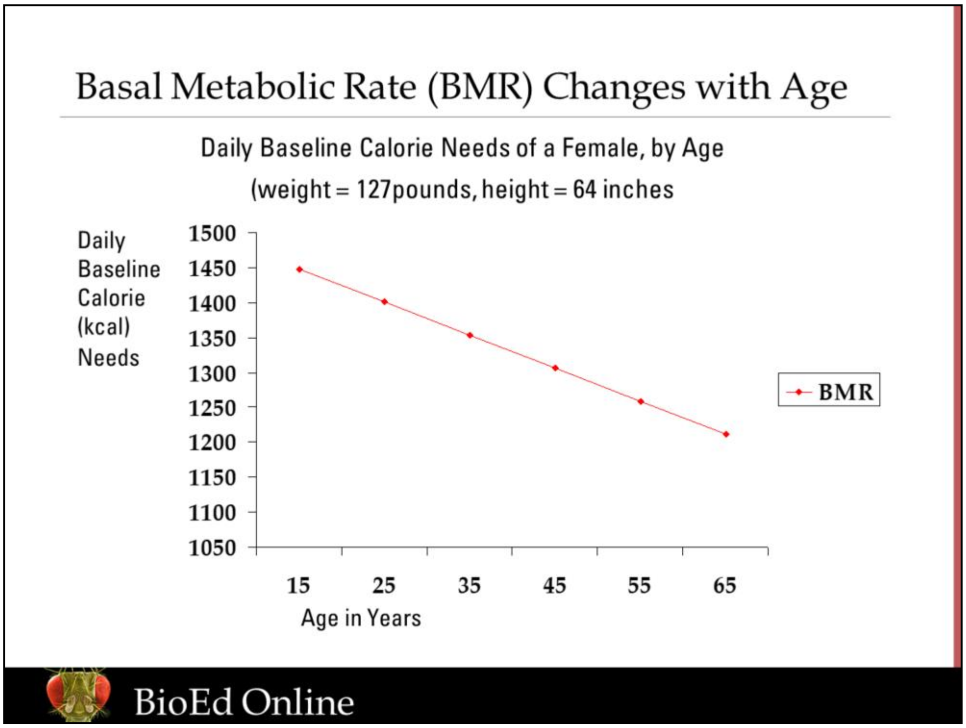


**Basal Metabolic Rate (BMR) Changes with Age**

As an optional activity, have students calculate Basal Metabolic Rate (BMR) for a person of the same height and weight, but using different ages in the Harris-Benedict equations. The graph above was created using a female with height of 64 inches and weight of 127 lbs. The BMR was calculated at ten-year intervals, beginning at age 15 years.

Harris-Benedict Equations:
For men, BMR = 66.5 + (13.75 x Weight) + (5.003 x Height) - (6.775 x Age).
For women, BMR = 655.1 + (9.5663 x Weight) + (1.85 x Height) - (4.676 x Age).

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<http://www.bioedonline.org/resources/nsbri.cfm>

**Reference**:

Harris, J., & Benedict, F. (1919). *A biometric study of basal metabolism in man*. Washington D.C.: Carnegie Institute of Washington.