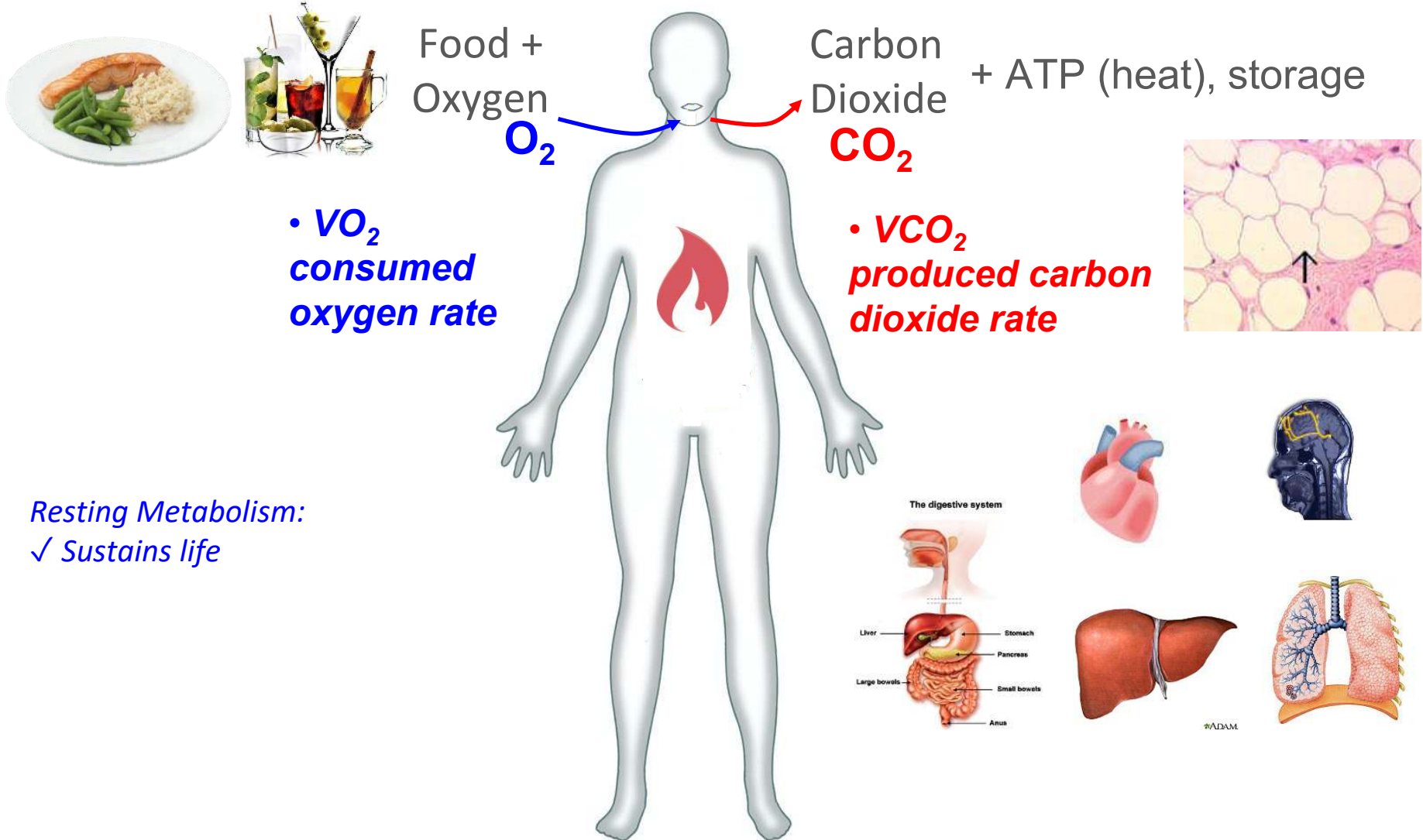


Case Study #3

How do we measure Resting Metabolic Rate (RMR) or Resting Energy Expenditure (REE)?

Resting Energy Expenditure (REE) = Resting Metabolic Rate (RMR)



Resting Energy Expenditure



Indirect Calorimetry Principle

Weir Equation:

$$\text{REE (kCal/day)} = [3.9 (\text{VO}_2) + 1.1 (\text{VCO}_2)] \times 1.44$$

VO_2 : consumed oxygen rate (mL/min)

VCO_2 : produced carbon dioxide rate (mL/min)

Weir, J. B. D. (1949). "New Methods For Calculating Metabolic Rate With Special Reference To Protein Metabolism." *Journal Of Physiology-London* **109**(1-2): 1-9.

Weir, J. B. D. (1990). "Nutrition Metabolism Classic - New Methods For Calculating Metabolic-Rate With Special Reference To Protein-Metabolism." *Nutrition* **6**(3): 213-221.

Importance of REE for weight management



Position of the American Dietetic Association: Weight Management

This paper endorsed by the American College of Sports Medicine

J Am Diet Assoc. 2009;109:330-346.

EAL Recommendation “Estimated energy needs should be based on [resting metabolic rate]. If possible, [resting metabolic rate] should be measured (eg, indirect calorimetry).

Rating: Strong

ALSO in:

H. Seagle, G. W. Strain, A. Makris, and R. S. Reeves, "Position of the American Dietetic Association: Weight Management," *Journal of the American Dietetic Association*, vol. 109, pp. 330-346, 2009.

Academy of Nutrition and Dietetic, 2012.

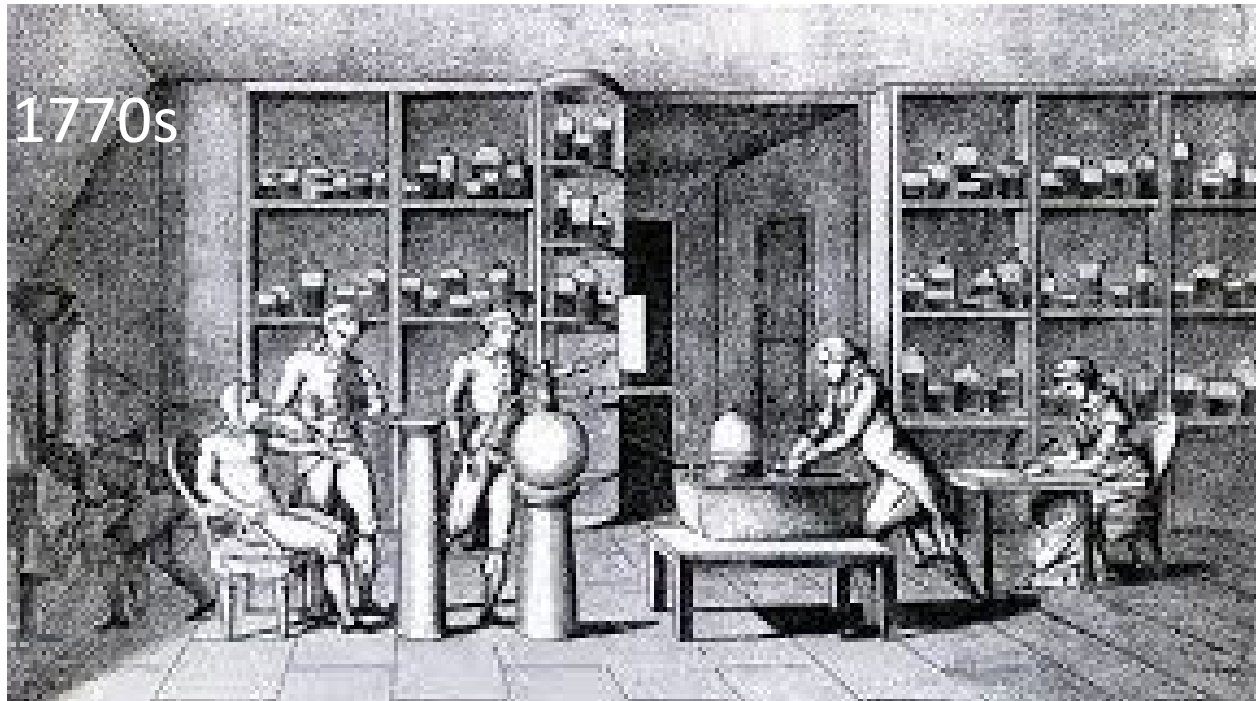


History of Measuring Energy Expenditure

1770's 1890's 1900's 1940 1980 2000 2010 **2014**

Lavoisier & Laplace

Law of the conservation of energy → First Human Calorimetry



Antoine Lavoisier
1743-1794

Indirect Calorimetry Method

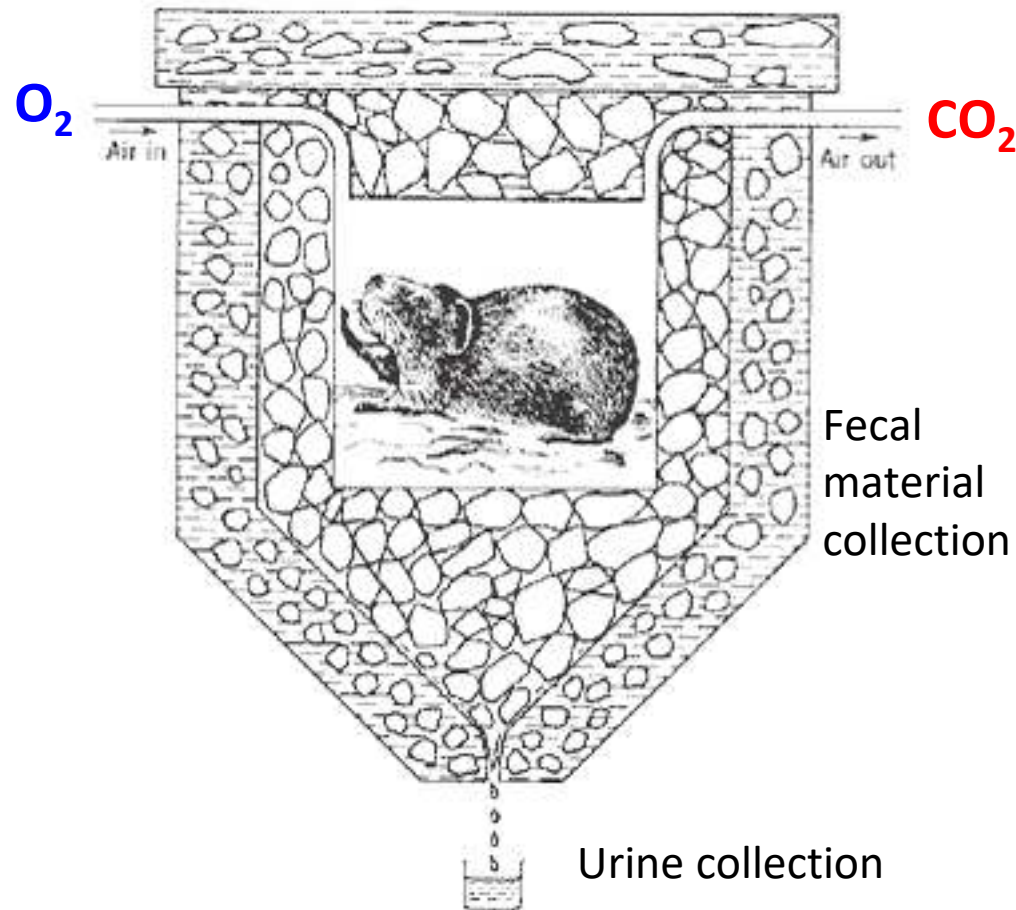


FIGURE 5. Antoine Lavoisier's calorimeter. This device was large enough to measure the heat generated by a guinea pig.

History of Measuring Energy Expenditure

1770's 1890's 1900's 1940 1980 2000 2010 **2014**

Lavoisier & Laplace
Law of the conservation of energy →
First Human Calorimetry

Atwater & Rosa
Wesleyan Univ.:
First important work
of Direct Calorimetry

+
Analyzers



Direct and indirect calorimetry

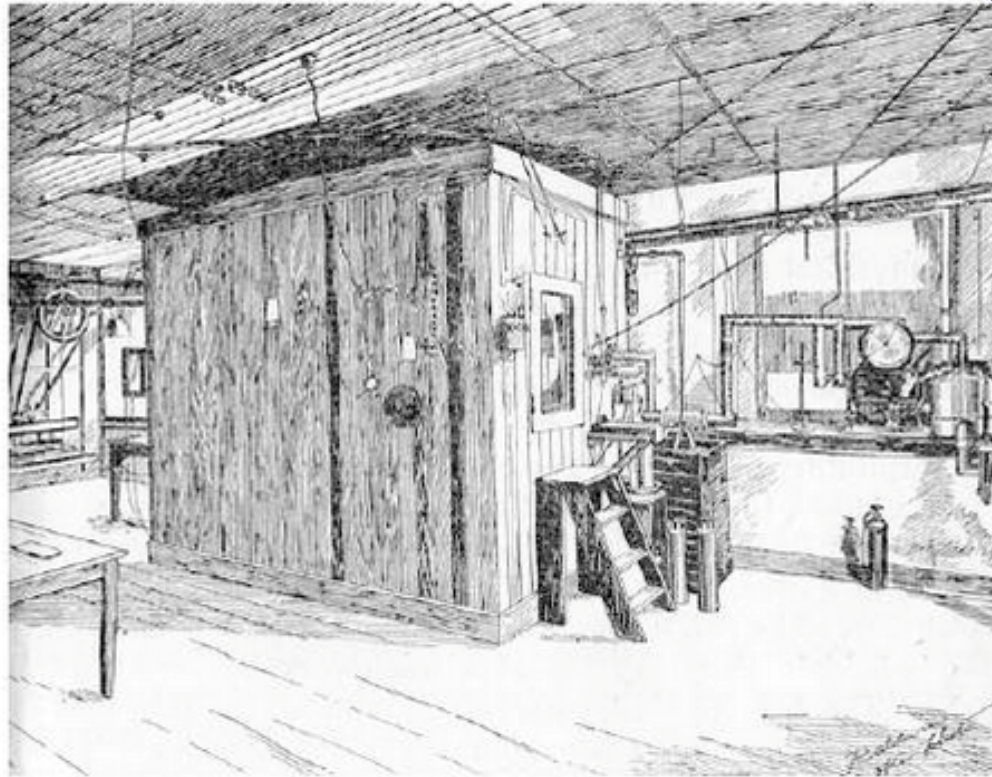
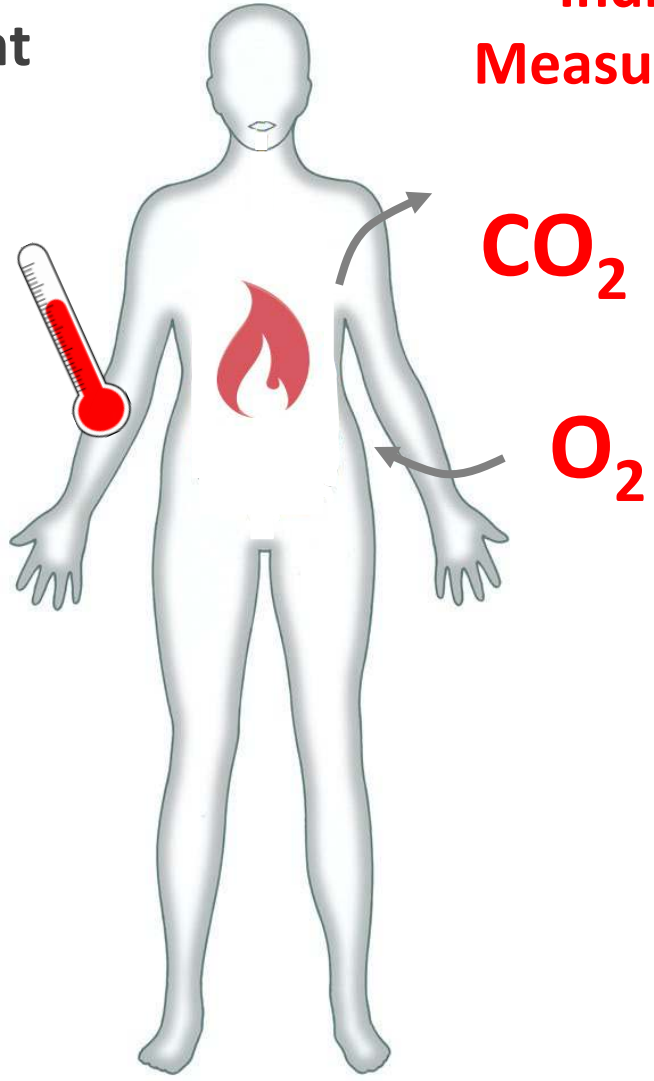


FIGURE 6. Wilbur Atwater's whole-body calorimeter for measuring calorie input and output in human volunteers. Someone could live in this device for days at a time while Atwater and his colleagues measured everything the volunteer ate, drank, excreted, and breathed. Source: Atwater, Woods, and Benedict, 1897 (see note 2).

Direct Calorimetry vs. Indirect Calorimetry

Direct
Measurement

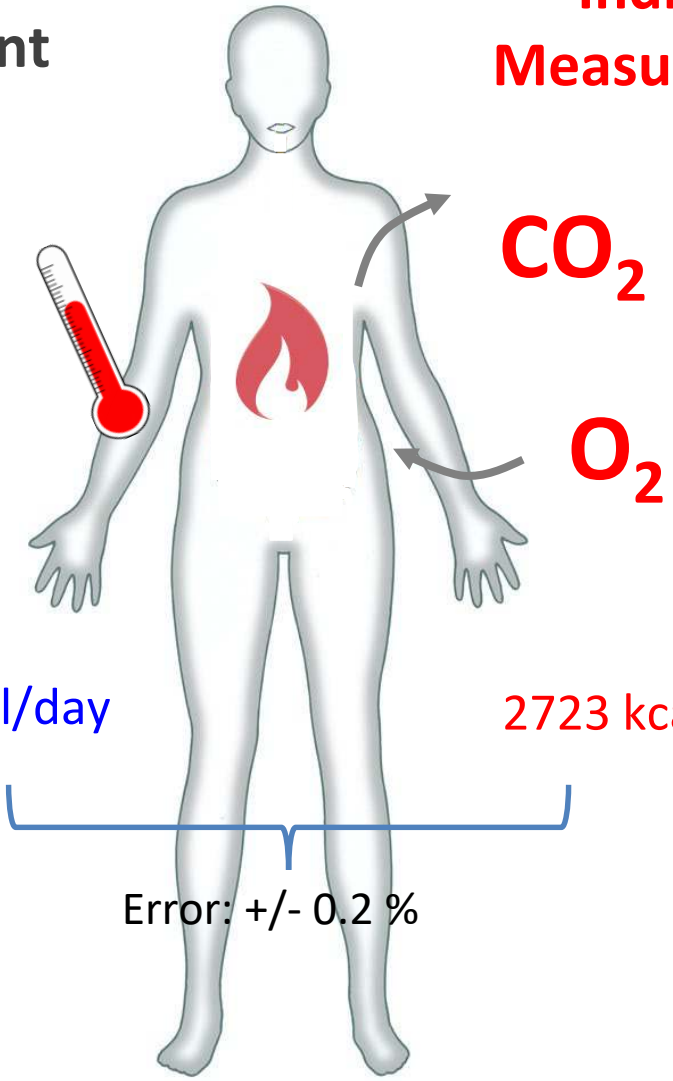
Indirect
Measurement



Direct Calorimetry vs. Indirect Calorimetry

Direct Measurement

Indirect Measurement



1900 - Atwater & Rosa' research:
Energy expenditure of 3 men who lived in the calorimeter for 40 days

2717 kcal/day

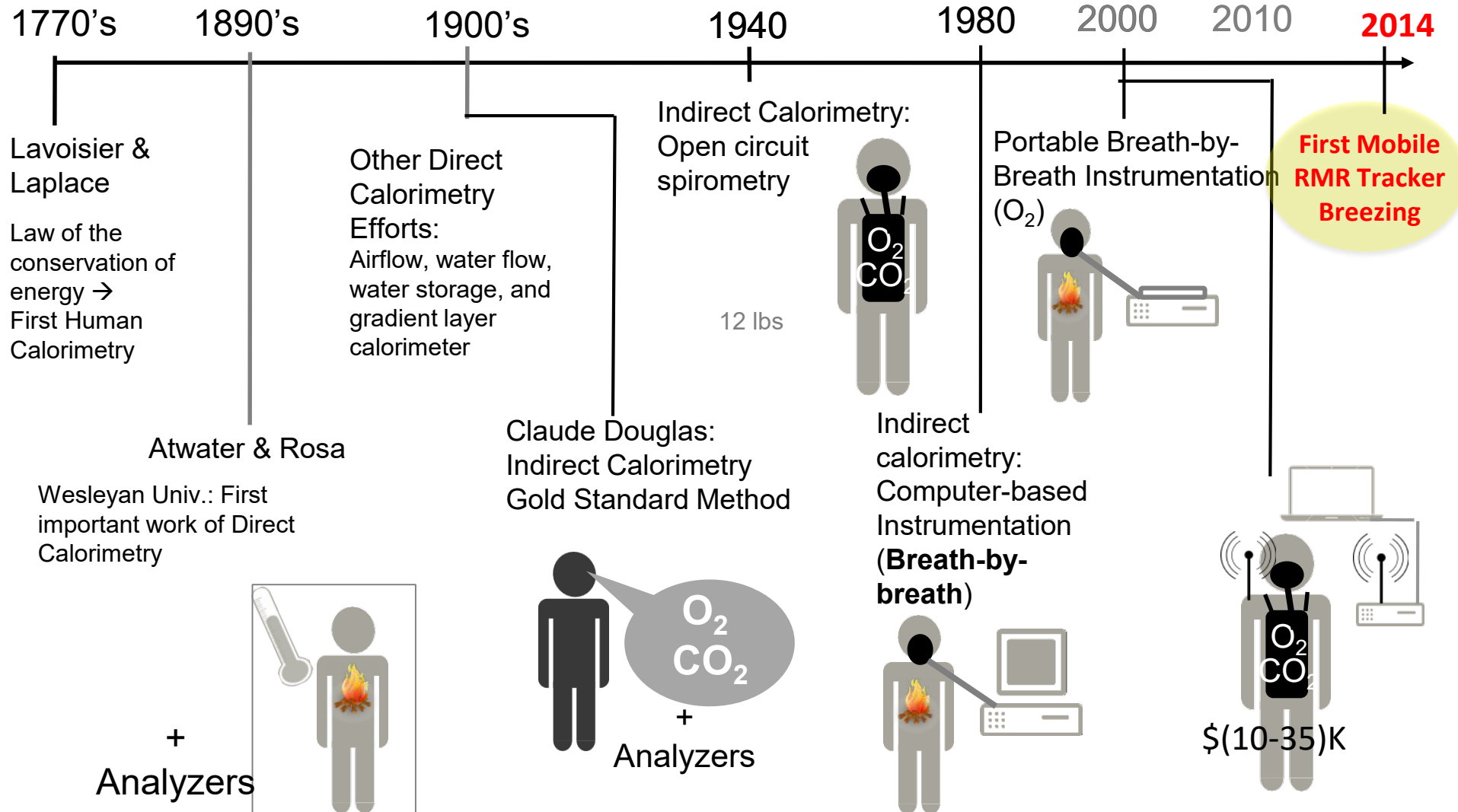
2723 kcal/day

Error: +/- 0.2 %

Science demonstrated that direct calorimetry is equivalent to indirect calorimetry

* Other researchers' experiments: Error = +/- 1%

History of Measuring Energy Expenditure



Thank YOU !

Questions to:

info@brezing.com