

## Layman's Guide to Calorimetry, and eCAL

### Calorimetry

Calorimetry is the science of measuring the heat of chemical reactions or physical changes.

This branch of science was first developed in 1780 by Lavoiser who noted that living organisms produced heat from their consumption of oxygen and their production of carbon dioxide and nitrogen waste.

There are two forms of calorimetry typically used in Human measurements, direct calorimetry and indirect calorimetry. Cost and complexity means the direct calorimeter is not practical for use in the clinic and for more than 30 years Indirect Calorimetry has been the mainstay of research in Nutrition departments, Sport Science departments and Intensive Care units.

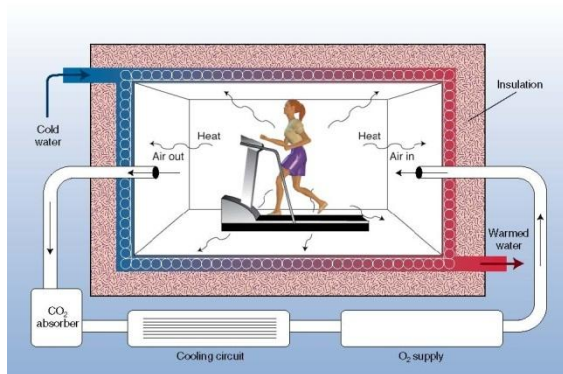


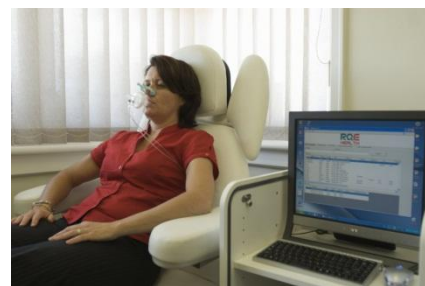
Figure 1 Direct Calorimeter



Figure 2 Indirect Calorimeter

### How do we measure Energy Levels?

The human body manufactures energy in cells by using oxygen from the air to breakdown (oxidize) nutrients from different foods. Therefore by accurately measuring the amount of oxygen inhaled and exhaled it is possible to calculate the amount of energy manufactured in units called calories.



### What else can we do with Indirect Calorimetry?

By measuring the amount of carbon dioxide exhaled it is possible to determine the type of fuel that is being used to generate energy. For example large amounts of carbon dioxide are produced from the burning of glucose. We can also assess the efficiency of the cells to generate energy through the burning of oxygen. This is an important indicator of health.

### Why are these measures important?

1. Currently energy needs are estimated, by using equations developed over the last 90 years. For Weight Loss these equations are very inaccurate and misleading.
2. If you want to lose weight – you need to burn fat. However if the body is only burning glucose (from Carbohydrates) then you cannot burn fat, and will not lose much weight. Currently there are no reliable methods to measure this other than through Indirect Calorimetry and yet it is fundamental to Weight Loss.
3. Poor Energy efficiency is a strong predictor of weight gain, fatigue and even chronic health problems such as diabetes and certain neuro-degenerative disorders, such as ALS. Measuring mitochondrial efficiency (which is what we are actually looking at when measuring energy efficiency) can be conducted in University departments, but there is no other means of achieving this in the clinic.

### Indirect Calorimetry today

There are a number of indirect calorimeters available in the UK today. They vary in price and complexity from £8,000 to £90,000. Typically the simple/cheap machines can only measure Oxygen, and are usually used in University Departments for teaching purposes. Some more complex machines may also be used in Sport Science departments and in Academic research. A number of high end devices are currently used in Intensive care, and neo-natal care. There are some machines available for clinic based nutrition that are similar to **eCAL** however none have the ease of use or interpretative features of **eCAL**.

### eCAL Indirect Calorimeter

**eCAL** is a small accurate Indirect calorimeter specifically designed to measure energy levels in humans at rest. It is designed and built in Western Australia and has been tested on more than 1000 subjects.

**eCAL** will be used in the following areas;

- Weight Loss
- Chronic Fatigue/Tiredness
- Energy Optimisation for Sport



Although it has a small footprint **eCAL** is more than capable of competing with its far more expensive competitors. The reason for this is our unique software **eHEALTH** that analyses and interprets the metabolic data derived from the machine.

From this software we can analyse the following;

- Daily energy needs
- Cellular energy efficiency
- Which fuels are being used
- The effects of treatment/interventions e.g. exercise, supplements

From this analysis our software gives advice to practitioners and clients, about how to optimize their energy levels, how to improve their diets, how to lose weight.

**eCAL/ eHEALTH** is the first system designed to support dieticians, physiologists and other health practitioners with scientifically validated weight loss and energy technology.