

# The Flow of Electricity

by Margaret Wegener

## Experiment Overview

This experiment investigates the parameters that affect the flow of electricity. Initial measurements enable comparison of resistance through various pathways involving current flow from hand to hand, across the chest. Then separate investigations test variation of electrical resistance with material properties – charge carriers – and variation with geometrical shape of pieces of a particular material (ie: as resistivity is kept constant). The experiment provides opportunity to apply Ohm's law in practical situations, in order to better understand the basic principles of electrical safety. From the experiment students should conclude how best to reduce (by insulation) the risks of electrical hazards.

## Learning Experience

Versions of this experiment have been used in our teaching laboratory for at least 10 years. It has garnered positive comment from the AIP accreditation panel. In surveys over a number of years students have commented on the positive learning experience of pracs in this course; as this is one of about four experiments that students do in the course, it can be inferred that this experiment contributes significantly to that experience.

## Aims and Objectives

This experiment investigates the flow of small electrical currents through the human body, so deals with fundamental concepts of electricity in a manner relevant to students in the biomedical and life sciences.

## Learning aims for the experiment:

### **Physics concepts**

Effects of current flowing through body

Electrical circuit

Insulation

Relationship of current to resistance of current pathway

Dependence of resistance on physical parameters

### **Scientific and practical skills**

Using multimeter

Equipment check/calibration

Calculating ratio to enable comparison between different situations

## Level of Experiment

First year

## Keyword Descriptions of the Experiment

### **Domain**

Electricity

### **Specific Descriptors**

current, resistance, resistivity

## Course Context

This experiment is for a course designed to teach the relevant fundamentals of physics to students interested in the biological sciences.

## Prerequisite Knowledge and Skills

In the course the experiment accompanies lectures covering the topic. Students are expected to be familiar with the theory of DC current, resistance and simple electrical circuits. They are required to be proficient in algebra – re-arranging equations, solving for unknowns, etc. The experiment is designed to be done by students working in small groups of two or three people.

## Time Required to Complete

**Prior to Lab:** 1 hour

**In Laboratory:** 3 hours

**After Laboratory:** none

## Experiment History

An earlier version of this experiment was inherited prior to 2001. The 2001 version used coils of wire 50 m and 100 m long for measurable resistances. In 2002, in order to have the resistance experiments use wires of length scales comparable to the human body, appropriate parameters were investigated; for the fine wires which were chosen as a result, apparatus was designed to mount the samples in a way that is robust enough to withstand handling, and that facilitates electrical contact with probes during measurements. In 2009 the experimental notes and tasks were revised to improve the match to learning aims (now explicitly stated).

## References

Standard textbook material on DC electricity, eg: Walker, [Physics](#), Section 21-1, 2