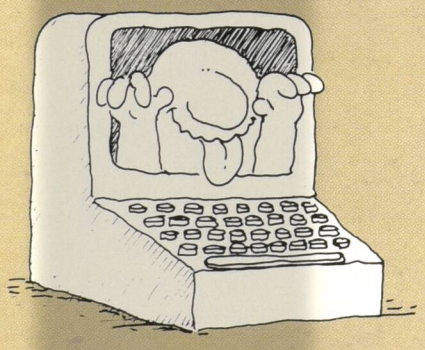
cumference), physicists will be able to accelerate electrons and positrons (antielectrons) to unprecedented speeds, creating collisions with enough energy to easily shake out the W and Z particles.

The National Research Council will play a crucial role in this project. In a joint effort with Carleton University, the NRC High Energy Physics section plans to produce part of the sophisticated detection equipment used to examine particles. According to Carleton University physicist Robert Carnegie, NRC and Carleton were chosen for this task because of their 15-year experience in producing extremely accurate detection devices for high energy physics labs across the globe. A recent example is the "time projection chamber," developed by the NRC High Energy Physics section, now taking data at the TRIUMF Laboratory in Vancouver.

Electromagnetic ghosts

Electric garage doors seemingly open and close on their own, computers don't function properly, and the information stored on word processors is mysteriously wiped out.

No, we're not being haunted by a modern day poltergeist with a penchant for electrical gadgets. These



uncanny occurrences are caused by electromagnetic waves which are crowding our environment more and more every day.

Radio transmitters, microwave ovens, transmission towers, and even calculators emit these waves, and in an attempt to prevent them from causing further problems, scientists at the National Research Council's Division of Electrical Engineering are helping the Canadian Standards Association write voluntary standards for electrical equipment manufacturers to follow.

Researchers Fred Hunt, Satish Kashyap, William Lavrench, Shantu Mishra, and Alex Stone have built a specially calibrated cell that not only tests the effect of radio waves on various pieces of electrical equipment, but measures the waves that they give off. The cell, which is similar in appearance to a backyard gazebo, is a 3-m^3 room, tapered at two opposite ends, and enclosed entirely within a copper screen. As such it is protected from outside radiowave interference. At one tapered end, a signal generator sends out radiowaves at well defined frequencies which bathe the equipment to be tested in the cell; the opposing tapered end contains a radio frequency absorber which absorbs the energy not taken up by the equipment under test.

The team of engineers constructed the cell last summer, and have just finished calibrating it -- that is, they have demonstrated that the fields they generate are in accord with design predictions.

Various kinds of electrical equipment are now being placed in the cell and carefully monitored. Apart from testing the common household receivers like televisions and radios, the group intends to look at interference to such new technology items as home computers.

The cell can be used in experiments involving radio waves from the lowest possible frequencies up to about 60 MHz. If higher frequencies are sent through the chamber, the waves become non-uniform and unpredictable. A special chamber has to be constructed for experiments involving higher frequencies.

In addition to helping the CSA write standards for electrical equipment manufacturers, the scientists assert that their experiments can further research in this field by developing new devices, procedures, and test methods for others to follow. The cell has already been used to calibrate antennas and probes used in the testing of electromagnetic fields.

Brown fat

Obesity is usually thought to be the result of overeating and a lack of physical activity. But research on rats and mice during the last few years has shown that a body tissue called

brown fat may be acting as a weight regulator, maintaining body weight within certain limits just as body temperature is regulated.

A few years back, NRC's Dr. David Foster showed that rats exposed to cold maintained body temperature, not by shivering, but through heat produced by their brown adipose tissue, or brown fat. This tissue, present in only small amounts, is located near the body's vital organs where temperature maintenance is essential. Workers studying genetically obese mice (which cannot survive the cold) then found that these animals have defective brown fat. Other laboratories discovered that this same tissue in rats increased in size and metabolic activity in response to increased food intake. The rats were fed a so-called 'cafeteria' diet (lots of rich food) which caused them to gain weight, but not nearly as much as expected from the calorie intake. And, once off the diet, the animals quickly returned to normal weights.

Says Dave Foster: "It has been suggested on the basis of these animal tests that, in adult humans, brown fat might be burning up excess calories."

What is it about brown fat cells that allows them to behave in this way?

Foster and others now think they know. The explanation is tied to an understanding of how a cell processes the food molecules that power it.

Carbohydrates and fats are normally broken down or oxidized by cells to produce adenosine triphosphate (ATP), which in turn is used to drive the cell. ATP is the cell's 'energy currency' for carrying out all of its metabolic activities. Food breakdown is usually controlled in a cell by the rate at which ATP is used up. In brown fat cells, however, a special protein called *thermogenin* uncouples food oxidation from ATP