production, so that all or nearly all of the energy from oxidation is converted directly to heat. The burning of food is thus not dependent on the energy requirements of the body. Researchers believe that obesity in mice could result from defective thermogenin.

But, there are other possible explanations for brown fat malfunction. Oxidation in brown fat cells is regulated by the sympathetic nervous system, which signals the cells with a chemical messenger called norepinephrine. Receptors, proteins in the cell membrane, interact with this hormone and transmit the signal to the metabolic machinery within the cell to start burning fat for heat production. Two different types of membrane receptors for norepinephrine are known, called alpha and beta. Dr. Foster discovered that brown fat alpha receptors modulate the response of the betas, which signal the cell to produce heat.

"As a crude analogy," explains Foster, "the role of the alpha receptors might be to change the tension on the trigger of a gun. Beta receptors are the trigger, and the squeeze that needs to be put on the trigger is controlled by the alpha receptors."

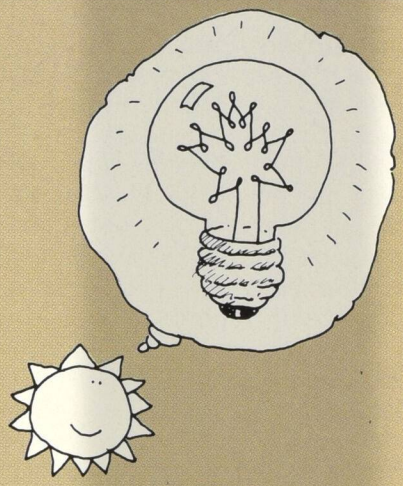
Foster says this adds a new level of complexity to the study of brown fat. "It's another potential site where something could go wrong in the ability of brown fat to be activated."

More on this research in a future issue of *Science Dimension*.

Canadian-tailored photocells

Throughout the world, despite the current oil glut, many countries are turning to the sun as an alternate energy source. In Canada, solar energy is still used sparingly, but a group at Ottawa's National Research Council is doing research it hopes will create viable solar energy systems for the Canadian environment.

The group, led by John Ayer of the NRC's Electrical Engineering Division, is analysing existing photovoltaic power systems (which convert solar energy directly into electricity) and attempting to adapt them to Canada's needs. Until recently, the handful of low-power photovoltaic power systems set up in Canada have been mainly American-made, says Ayer. "There's no reason why



we shouldn't be designing and manufacturing our own systems," he says.

Because the sun over Canada is low in the sky for much of the year, large-scale urban power systems, which are economical in many sun belt countries, may not yet be feasible here. But because Canada is so huge, there are many remote locations where a photovoltaic system may be the best energy source.

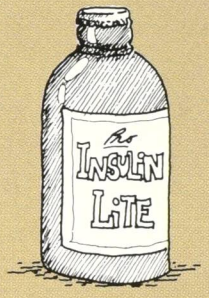
A prime example is Canada's largest photovoltaic power system, located in the wilderness near Atikokan in northwestern Ontario, five miles from the nearest power lines. This two-year-old system, built by the Ontario Hydro and NRC provides 300 watts of continuous power to run an air pollution instrumentation system.

A similar case is a low power (50 watt) photovoltaic system designed by Ayer's group which is used as a power source for instruments measuring the water level and other factors in the Ottawa River. These instruments were previously powered by a diesel generator, which required many expensive trips for maintenance. According to Ayer, Environment Canada plans to use more of these photovoltaic systems at the many other remote monitoring stations scattered throughout Canada.

The group is also making a long-term comparison study of photovoltaic panels produced by the three Canadian and some top American manufacturers, to see which panels perform best in the Canadian environment. About 30 panels, mounted on the roof of an NRC building have been battered by Ottawa's wind, rain, snow, cold and heat for the last two years. They are constantly monitored by a computerized system which measures and records power output and compares it with sun brightness, temperature and other environmental conditions.

In addition to analysing panels, Ayer's group is doing work on the other parts of the photovoltaic system, such as improving the ability of batteries to store solar electric energy when the sun is not shining. Research is also being done to improve the efficiency of devices which convert the DC electrical power commonly used in Canadian homes and business.

Ayer says he hopes Canada can follow the example of other countries now building "utility-interactive" photovoltaic power systems, which combine solar energy power sources with traditional electrical power. Even if Canada uses photovoltaic systems on only a small scale domestically, Ayer says the technology developed will not be wasted. "There is a growing export market for solar energy technology, especially among some of the sun belt countries," he says.



Yeast insulin

Piotr Stepien, David Thomas, and their colleagues at the National Research Council's molecular genetics laboratory have succeeded in getting man's oldest domesticated animal — yeast — to produce proinsulin. Unfortunately, the quantities are far too small to make industry sit up and take note yet.

Already, NRC's Saran Narang and biologists at Cornell University in the U.S. have genetically engineered a bacterium (*Escherichia coli*) to produce a synthetic human proinsulin gene. (The human body uses proinsulin to produce the hormone insulin.) Stepien and Thomas decided to focus their research on yeasts rather than bacteria because they are safer in relation to humans. Unlike *E. coli*, yeasts are not normal inhabitants of man and, therefore, their toxicity is much lower.