Yeasts have other advantages. Thanks to the ancient industry of fermentation, the genetics and growth conditions of these single-cell organisms are well known. Yeasts are also more advanced or "eukaryotic" cells (as are the familiar plants and animals) so their capacity to produce complex molecules is greater than that of bacteria.

For the yeast to produce proinsulin, the gene for proinsulin must first be "introduced" to the yeast cell. This is accomplished by recombinant DNA methods. Basically, a gene coded for proinsulin is inserted into a plasmid which has been cleaved, or cut open, with a special enzyme. (A plasmid is a naturally occurring loop of DNA that exists within a cell.) The "recombined" plasmid is then put back into a cell. When the cell reproduces itself, it also reproduces or "clones" the recombined plasmid. The idea is to have these cells also translate the foreign gene's message into the desired protein product (proinsulin).

As the NRC workers realized, however, there are problems with obtaining proinsulin in this way. Yeast cells recognize the protein as foreign and destroy it. But, if it is spliced into something the yeast is familiar with (such as the enzyme galactokinase — also a protein), the yeast can be tricked into accepting it. To get such a hybrid protein, the researchers had to first produce a hybrid gene — that is, a proinsulin gene spliced into the gene for galactokinase.

But the proinsulin gene cannot be attached to the galactokinase gene at just any spot; it has to be at the right "reading frame." Think of the galactokinase gene as a paragraph and the proinsulin gene as a sentence. A proinsulin "sentence" will make sense within the galactokinase "paragraph" as long as the punctuation is observed — there must be a clear message to 'start' reading at the beginning of the proinsulin gene.

Knowing that the galactokinase gene has two positions in it where the correct punctuation for "read" is easily accessible, the NRC group was able to insert the proinsulin gene at each of these sites, and induce the yeast to produce proinsulin joined to galactosidase protein.

The major disadvantage to the technology as it exists now is the low yield. Although about 5 per cent of the total protein in bacteria modified for the purpose is proinsulin (proinsulin protein is converted by the cell to insulin), the yield from yeasts is lower than 0.01 per cent. This means a lot more work has to be done in the laboratory before industrial production becomes feasible. Theoretically, this galactokinase disguise technique should yield 2 per cent proinsulin — the figure Stepien is aiming for.

A liquid mirror

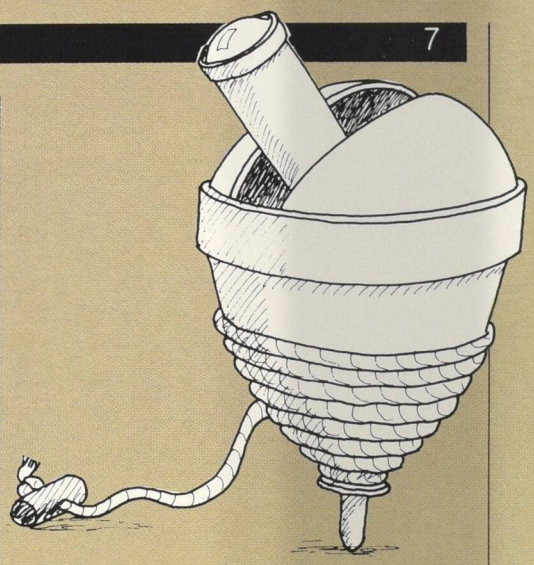
The year is 1909. The American astronomer R.W. Wood plans to develop a telescope with a *liquid* mirror! This ingenious concept, first put forward by a researcher in 19th century England, is based on the principle that the surface of a rotating liquid assumes the shape of a parabola. Unfortunately, the project faces difficulties which, for the time, are insurmountable, and it is abandoned.

Now, some 70 years later, Professor Ermanno Borra of Laval University has taken up the challenge. He feels that the concept is basically sound, and intends to prove that such a liquid-mercury instrument can be built.

If Borra succeeds, it would be possible, at least theoretically, to build telescopes measuring 10, 20, or even 30 m in diameter (the largest existing telescope measures 6 m in diameter). Furthermore, the cost of liquid mirror telescopes would compare very favourably with that of conventional telescopes. The size and originality of such an instrument would, of course, raise a number of design problems, but Dr. Borra feels that modern technology can overcome the difficulties which R.W. Wood found insurmountable.

For the moment, the Laval professor is determining the feasibility of the concept using small liquid-mercury mirrors, and thanks to grants from the Natural Sciences and Engineering Research Council (NSERC), he has already developed mirrors measuring 0.5 and 1 m in diameter, suitable for conventional telescopes. Once he has tested mirrors 1.64 and 2 m in diameter, he plans to build a complete telescope with a liquid-mercury mirror 6 m in diameter.

Because of basic design constraints, such a telescope can only be



aimed towards the zenith (straight up), but it will have a limited ability to track distant objects. In fact, its most effective use will be in observing very distant, low-light objects. Because of its size and high resolving power, the mercury telescope could extend mankind's vision considerably in the search for distant galaxies, supernovas, and quasars.

FRS London

Last April, Professor Pierre Deslongchamps, of the University of Sherbrooke's Department of Chemistry, was elected Fellow of the Royal Society of London for his work in organic synthesis and for the development of his theory on the stereoelectronic control of chemical reactions.

Prof. Deslongchamps has been doing research at Sherbrooke since 1967; the theory he developed holds that the course of a chemical reaction, as well as the nature of the resulting products, is determined by the spatial arrangment of electron pairs within the chemical bonds. This so-called stereoelectronic theory promises to be useful in other areas of chemical research such as the study of enzyme activity.

Prof. Deslongchamps has received several awards and scholarships, including the 1971 Steacie Award given out by the Natural Sciences and Engineering Research Council (NSERC). He is the author of many publications, and a Fellow of the Royal Society of Canada.

Cartoons by John Bianchi