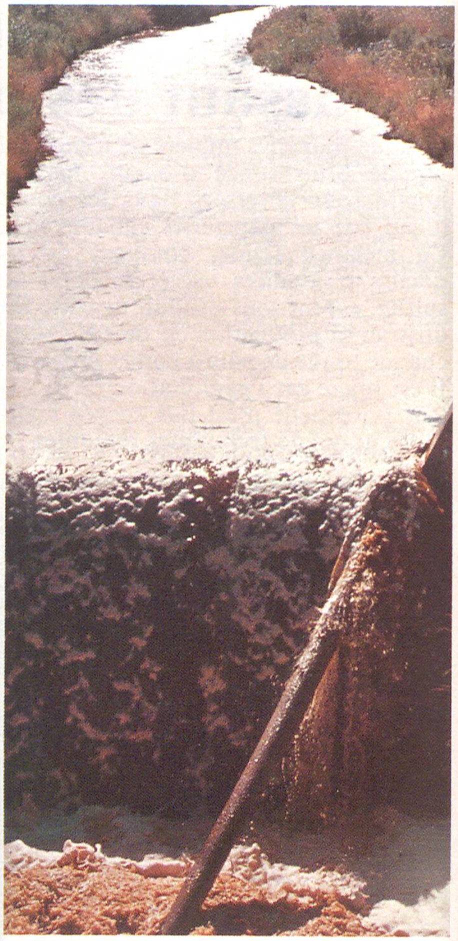
clude other yeasts. If one yeast can ferment a pentose, perhaps other yeasts not only have the same ability but are more efficient at the job. "Actually, pentose-fermenting yeasts turned out to be quite common once we knew what we were looking for," notes Schneider. Finding a yeast that can function under conditions that are already used in industry would make it unnecessary to spend time and money adapting existing equipment to the conditions required for the efficient use of *P. tannophilus*. The search continues, then, for a yeast that is already well suited to existing industrial conditions. "If we can't find one, we'll make one," states Schneider confidently.

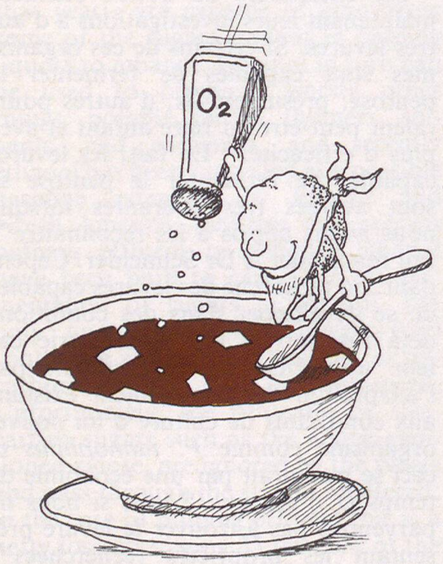
Brewer's yeast (*Saccharomyces cerevisiae*) is well known in industry, playing a part in many processes such as bread and wine making. As the technology and equipment already exist to make optimum use of the fermentation properties of brewer's yeast, Dr. Schneider and his colleagues are working with it first. In the attempt to coax this yeast species to ferment pentoses, the team has excised the genetic sequence from the DNA of *Escherichia coli* (a bacterium) that allows it to ferment pentoses and is in the process of inserting it into the DNA of brewer's yeast. *Escherichia coli* was used because its genetic structure is so well mapped already and locating a segment bearing the correct genetic sequence was not difficult. Because *E. coli* is a bacterium, though, Schneider is not confident that the yeast will be able to make use of the new genes in its DNA. In that case, he plans to excise the correct gene sequence from a yeast like *P. tannophilus* and incorporate it into the genetic structure of brewer's yeast. The result should be brewer's yeast with the capacity to ferment pentoses.

Although Dr. Schneider makes all this sound like a kindergarten exercise in cutting and pasting, this "exercise" could take from six months to three years, depending on the difficulty in locating and extracting the correct gene sequence.

Meanwhile, industry is anxious for applicable results. At present, there are 14 sulphite mills in Canada considered large enough to produce ethanol economically. The smallest of these mills produces about 870 t and the largest mill about 3 270 t of spent sulphite liquor per day. Small wonder that camping on the doorstep is no longer sufficient. Industry has decided to move in. In December 1981, two researchers from Tembec Ltd., Temiscaming, began working in Dr. Schneider's laboratory. (CIP, Hawkesbury, has set up a laboratory to do research in the same area.) The two companies have received contracts from NRC's Program for Industry/Laboratory Projects (PILP), a program designed to bring discoveries made within NRC to industry where they can be applied commercially.

In the future it won't just be pulp and paper mills involved in this area of research. The principle of biomass conversion to ethanol by yeast has wide application in other areas of waste disposal. Canertech Inc. will be extracting ethanol from wood cellulose. Agricultural residues are very high in sugar content, and the increased amounts of ethanol possible by tapping the pentose content are considerable.





By dry weight, corn stover (everything but the cob) is 29 per cent xylose; wheat straw is 31 per cent xylose; poplar trees are 20 per cent xylose. Even *The Wall Street Journal* is 5.4 per cent xylose.□

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