

Dextran, Xanthan Gum, and Levan

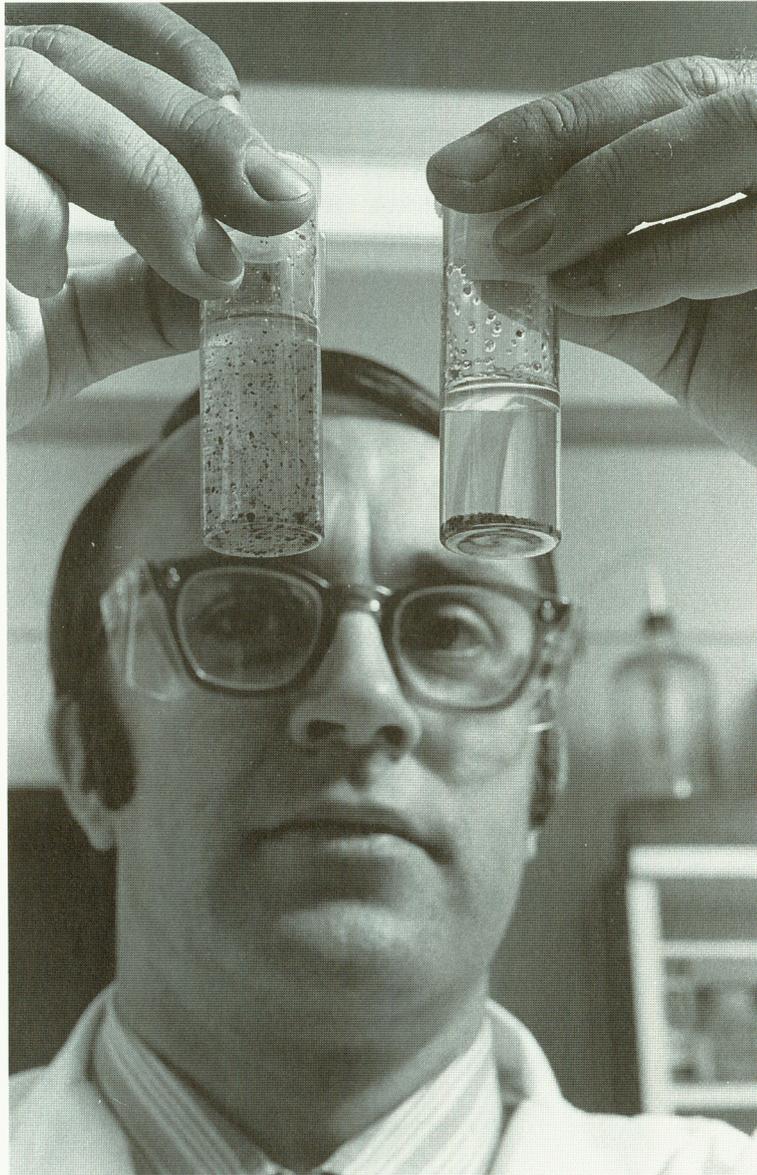
Three different microorganisms have been found to act on sugars to create three different products with unusual properties. All the products are polysaccharides—a class of carbohydrates that includes starch and cellulose. Their names are dextran, xanthan gum, and levan, and all are remarkable compounds.

It was in the 1950's during the Korean War that dextran was first administered intravenously to battle casualties as an alternative to blood plasma. It is credited with saving thousands of American lives. Economical methods for producing dextran were developed at the Northern laboratory. Dextran's chief advantage over other blood extenders, such as glucose or saline solutions, is that it persists in the blood longer—for days rather than hours. It even has several advantages over blood plasma itself. Unlike plasma, dextran can be sterilized, ensuring that it is virus free. Dextran can also be kept much longer than plasma without refrigeration, and it costs only about one-third as much. Finally, its supply is more reliable. Since it is derived from cane or beet sugar, it doesn't depend on blood donors.

The bacterium that ferments sugar to make dextran is named *Leuconostoc mesenteroides*. Found originally in a bottle of spoiled root beer, it was added to the Peoria lab's renowned collection of microorganisms. When the military made known its need for a blood extender, the bacterium was one of several selected from the collection for experimentation. It worked. Approved quickly for use in military medicine in 1950, dextran in 1953 was also approved for civilian use.

The second product, xanthan gum, is fermented from glucose by *Xanthomonas campestris*, another microorganism (see "Microorganisms," p. 134). Also developed at the Peoria lab, this edible gum has properties that make it ideal for many food and industrial uses. A relatively small amount is able to produce very viscous solutions. That is why it is listed as an ingredient in

The water-thickening property of xanthan gum, used to push out the petroleum that remains in older wells, is demonstrated by Peoria chemist Paul A. Sandford. Solution on left, containing 1-percent xanthan in water, has held sand in suspension for 72 hours; the sediment in plain water on right has fallen to bottom.



practically every salad dressing on the supermarket shelf. It is also found in many other grocery products today.

Another major use of xanthan gum is in extending the life of gas and oil wells that are nearly spent and have stopped producing. A solution of water and xanthan gum is pumped into the earth to push any remaining crude oil to pumping wells. It is also driven in with sand under high pressure to fracture rock in oil and gas wells. And it does the job!

Until recently, there was a problem in getting the xanthan gum back out of the wells without environmental risk. A retired Peoria microbiologist, however, found a microbe in the soil in his backyard that can degrade xanthan gum under the high-temperature and high-salt conditions present in natural gas and oil wells. He and an NRRC chemist have patented the process, which has attracted the interest of oil and gas people in the United States and Europe. Work is now under way to improve the process through genetic engineering of the microorganism.

Another fermented product, levan, is a natural gum made by microorganisms found in soil and in certain plants, including sugar beets. It is a waste byproduct of sugar processing. Scientists at the Southern laboratory, after identifying 28 soil microorganisms that can produce levan from sugar, found one, *Bacillus polymyxa*, that sharply increases levan yields. In fact, reports one researcher, it produces 3 times as much levan from a sugar solution, and in a purer form, than any of the other 27 microorganisms tested.

SRRC scientists are excited by the properties of levan, as earlier researchers were excited by dextran and xanthan gum. With increased competition from lower cost corn sweeteners and noncaloric sugar substitutes, the sugar industry needs to find products of value other than sugar. Levan, say researchers, may be one such product, with potential for use in the printing and cosmetics industries. Some think it could be used like xanthan gum as a thickener or even as a dextran-like blood extender.