

E. Coli

Ubiquitous Bacterium

A common organism, usually harmless but sometimes deadly, is of worldwide use in scientific experiments.

by Faye Marley

From science projects in a high school laboratory to sophisticated enzyme research at the National Institutes of Health, the intestinal organism *Escherichia coli* is doing yeoman service for bacteriologists.

Although obtainable commercially, the colon bacilli grow readily in less than 24 hours in a medium consisting of inorganic salts, an ammonium salt and glucose. They are usually frozen, and are often isolated from fresh, healthy human feces.

Named for a German physician, Theodor Escherich, who died in 1911, *E. coli* was first described by the scientist in 1886 under the name of *Bacterium coli commune*. The original culture was isolated from the excreta of a breast-fed infant, and cultures from this source were considered by Escherich to be especially typical.

The colon bacillus is found universally in the intestinal tract of man and in many of the higher animals. Because it is abundantly present in the colon it fully deserves the name originally given to it.

Although usually harmless and even thought to perform a useful function in suppressing the growth of some other organisms in the intestines, *E. coli* can get out of control, especially when it leaves its natural habitat. The bacilli invade the urinary tract most often, and they may also play a part in the formation of gallstones.

When the organisms travel to the lungs they can cause pneumonia. Twelve people died at the Detroit General Hospital of this type of pneumonia because other organisms in the sputum tested masked the presence of *E. coli*.

A report in *THE NEW ENGLAND JOURNAL OF MEDICINE* describes 20 pneumonia cases attributed to the colon bacteria. Five of them had been acquired in the hospital following surgery on the kidneys or gastrointestinal tract, and it is believed that the bacilli reached the lung from these sources.

The term "summer complaint" refers to a diarrhea caused by *E. coli*, which can also cause abscesses of in-

ternal organs, septicemia, or blood poisoning, endocarditis and meningitis. Cystitis, or inflammation of the urinary bladder, as well as nephritis, or kidney inflammation, have been traced to *E. coli*.

Investigators at Sloan-Kettering Institute for Cancer Research in New York are using *E. coli* in an attempt to produce an effective source of the enzyme L-asparaginase, used for remission of leukemia.

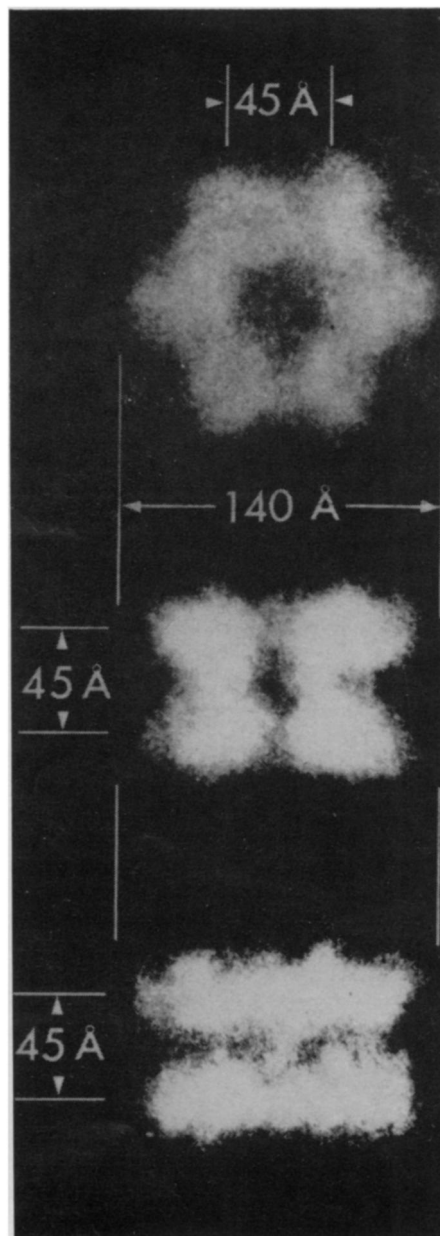
At present L-asparaginase is scarce and expensive. The Sloan-Kettering investigators, including Dr. Lloyd J. Old, are aiming their tests at the detection of tumors that need the amino acid so they will know which patients could be helped.

Basic enzyme research at the National Heart Institute laboratory, Bethesda, Md., was begun about five years ago, using *E. coli* to purify glutamine synthetase. Dr. E. R. Stadtman, chief of the laboratory, has been studying the way this enzyme turns off its own formative processes. The mechanism of inhibition, involved in feedback control, is being observed.

"A lot of people are studying enzymes," says Dr. Bennett Shapiro, who has been working with Dr. Stadtman for the past two years, "but not many laboratories are concentrating on glutamine synthetase. It is of interest because it is a central enzyme in nitrogen metabolism, and its activity is turned off by many of the body compounds that receive the nitrogen.

Down the hall from Dr. Shapiro, another scientist is working on an entirely different basic research project in which *E. coli* is used. Dr. H. Ronald Kaback is interested in the membranes of *E. coli*.

Dr. Kaback has been able to isolate a membrane system using mutant strains of *E. coli*. Mutants are valuable in studying the uptake phenomena by membranes, he explains. For example, the uptake of proline, one of the amino acids, is defective in a particular strain of *E. coli*, and membranes prepared from this strain show this defect.



Dr. Robin C. Valentine, London

One molecule of enzyme from *E. coli*.

In addition, the uptake of carbohydrates by membranes is in progress. He says that all cells, particularly the kidney, work by concentrating nutrient. Inborn errors of metabolism can be related to membrane work.

"Possibly," Dr. Kaback said, "basic studies such as these might be related to membrane phenomena in general."

One very practical use of *E. coli* is in relation to city water supplies. It is not a practical procedure to isolate the deadlier *Shigella* or *Salmonella* from samples of water, but sanitarians find that colon bacilli grow readily if they are present, and thus serve as a convenient index of fecal contamination. *E. coli* can also be used as a test of food contamination.