

"No one who has read the records of some of these lives and pondered on them can escape a profound sense of awe

at the biological toughness of the human species," she comments.

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## BIOCHEMISTRY

## Vitamin Factory

The fact that a cow's stomach can turn out a surplus of B-complex is again engaging the attention of scientists. Work is done by bacteria.

➤ A COW'S stomach is a vitamin factory, capable of turning out not only enough B-complex for her own needs but a surplus that is excreted with her digestive wastes. This fact, originally discovered in researches at Pennsylvania State College some 15 years ago, is again engaging the attention of scientists.

Specifically, the part of the cow's complex stomach where vitamins are produced is the pouch known as the rumen. The vitamin manufacture is not accomplished by the body processes of the cow herself but by swarms of bacteria living in the rumen, working on the often low-vitamin diet on which the animal feeds.

Vitamin benefits from the cow's digestive processes have been known in a crude fashion for a long time: it is a common barnyard observation that skinny, runty chickens "perk up" if they have a chance to scratch for chance grains in a heap of cow manure.

Conclusive evidence that vitamins of the B-complex are synthesized by bacterial action in cows' rumens was obtained in 1928 by S. I. Bechdel and associates, J. F. Shigley, Hannah E. Honeywell, R. Adams Dutcher, and M. H. Knutsen. They had found previously that young calves make normal growth on rations shown to be vitamin B-complex deficient in tests on rats.

Penn State Jessie, a cow which achieved great public interest because of the window in her side, figured largely in these vitamin B synthesis tests, supervised by Dr. Bechdel. Quantities of partially digested feeds were removed through this opening for chemical and bacterial analysis.

Subsequent experiments at other stations have shown that a cow produces sufficient of the B-complex vitamins for her own needs from feeds low in this constituent, and if properly fed, excretes large quantities which may be used by other animals.

Scientists and feed manufacturers now are concerned with the problem of how

to include the B vitamin eliminated in cow manure in feeds for other forms of livestock without offending customers or an over-sensitive public. The source of vitamin B fed may be quickly forgotten, however, if superior animal products result.

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## ELECTRONICS

## X-Ray Tube Takes Pictures In Millionth of a Second

➤ EQUIPMENT containing an X-ray tube which takes pictures in a millionth of a second is now used by an Army arsenal to study the behavior of a bullet passing through the bore of the gun and its piercing action as it hits an object, and also the behavior of a high-explosive shell as it hits a steel plate. It can also be used to study the action of the component parts of valves or of other machinery during operation, and to photograph accurately such action as the inner structure of golf balls at the moment of impact.

Ultra-speed X-raying is the "only adequate method of determining how a bullet or shell behaves as it hurtles down the bore of a gun or as it strikes the target," explained Dr. Charles M. Slack of the Bloomfield plant of the Westinghouse Electric & Manufacturing Company, who developed the tube, at a recent meeting of scientists in Cleveland. "One failed bullet might jam a machine gun, and studies made possible by high-speed X-ray photographs at arsenals and proving grounds in this country and in Great Britain have been of inestimable value."

Photographs with the new equipment show that a high-explosive shell inflates to twice its normal diameter just before it appears to finally burst open inside a steel plate, he said, and the blast that accompanies the firing of a rifle bullet will beat the missile to the muzzle of the gun.



**RADIOGRAPHS**—This series of high speed radiographs shows how a high explosive shell swells up just before it appears to burst open inside a steel plate. In the top picture, the nose of the shell is through the plate; almost half the shell has passed through in the second picture; in the third, the shell has just burst open; and in the last, the shell is wide open, the petals on the back of the plate curling back to make a large hole.

A series of radiographs made with the super-speed tube at an American arsenal showed that the 20-millimeter high-explosive projectile swelled, burst and disintegrated during the penetration process, he added. The force of the explosion blew a huge jagged hole in the steel plate.

The tube will have many postwar uses, he continued, in metallurgical and other industries. It can be used, he said, to study rapidly moving machine parts such as automobile valves. "We no longer will have to wait until those parts perform to see what causes unnecessary wear and failure. With the help of the high-speed X-ray camera we can watch those parts tick while they are ticking."

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