elucidate the fascinating problems of silk production—biological and biochemical—is in an exceptionally advantageous and a far happier position. If he is properly equipped, he can command a variety of experimental techniques and methods which have been developed in recent years. In this connection we must refer to the spectacular work of Zamechik and his colleagues (*Science*, 1949, 109, 624) who, working in the Chemical and Biological Laboratories of the Harvard University, have accomplished the biological synthesis of radioactive silk. They have tested the ability of the giant silkworm *Platysamia cecropia*, to incorporate radioactive glycine and alanine into the silk it synthesises. The radio activity was shown to be present in the α-carboxyl group of some amino acid associated with the silk fibre.

Silk is a protein, biologically elaborated by the silkworm and broadly comparable to the casein elaborated by the mammary glands of the cow, to the albumin of the egg laid by the hen and to the wool grown by the sheep.

Thanks to the brilliant and sustained researches of the European, the American and the Australian investigators, the efficiency of the three biological agencies—the cow, the hen, and the sheep—as converters of their respective feed proteins into their characteristic protein secretions—the casein of the milk, the albumin of the egg, and keratin of the wool fibre—have been worked out. The cow has been found to possess a conversion efficiency of about 80 per cent.; the hen comes next with an efficiency of only 50 per cent. In the case of the sheep, Australian workers have found that a daily dose of a gram of cystine increases the yield of wool by 30 per cent.

The biological efficiency of the silkworm as a converter of feed protein into silk protein is a problem which awaits solution. There are several other problems of similar magnitude and importance facing us in the field of silk production.

The All-India Silk Board, which, we understand, has been constituted, will, we hope, take up this question and lay down a progressive policy of vigorous and sustained research which must be recognised as the only infallible and rational means of placing the silk industry on a sound and stable foundation.

THE ATOMIC CLOCK

FOR many years, at the United States Naval Observatory and other national observatories where time is recorded and dispensed, quartz-crystal-controlled clocks have been used to keep time as accurately as does the earth itself—to about 1/1,000 of a second per day. Nevertheless, quartz-crystal clocks are subject to vagaries that have indicated the need for even more accurate means of control. This has now been found in what is known as the "atomic clock," developed at the National Bureau of Standards by Dr. Harold Lyons and members of the staff of the Bureau's microwave research laboratory.

The frequency of an absorption line produced in the microwave region of the spectrum by ammonia gas under a pressure of 10 or 15 microns is now used as the "governor" on apparatusc apable of time constancy of one part in 10 million, with a theoretical potential accuracy of one part in a billion or more. If the microwave signal output of a quartz-controlled frequency generator differs in frequency from that of the ammonia absorption line, the control circuits generate an error signal which brings the microwave signal back to the frequency of the spectrum line.

In addition to its obvious astronomical applications, such as furnishing an invariant check of the earth's rotation, the atomic clock will prove invaluable in many fields. It will provide room for more stations in the radio broadcast spectrum, as station transmitter frequencies can be maintained to very close tolerances. It will aid all radar operations and navigation systems that depend on radio, and will assist in basic research in microwave spectroscopy and molecular structure. (By courtesy to *Sky and Telescope*, 1949, VIII, P. 223.)