and liquid form. The main results are briefly reported here.

The seed used in the experiments was a sample of spring wheat naturally contaminated with spores of *Tilletia* spp., which cause covered smut of wheat. It was further artificially contaminated by the addition of 0.5 g of similar spores to each 100 g of seed. Portions of the infested seed were treated with different amounts of actidione dusts consisting of mixtures of a finely powdered clay and the antibiotic in one type of treatment, and with actidione diluted with a 0.02% aerosol and water mixture in another. Three types of checks were included: one untreated, one to which the clay dust only was applied, and one which was immersed for 1 min in a 0.02% aerosol and water mixture. The seed was treated one day and sown the next. Four replicates (100 seeds/replicate) of each treatment and each check were sown in randomized rows in a bed of black soil in the greenhouse. The most important results are presented in Table 1.

TABLE 1

EFFECT OF RAPID SEED TREATMENTS WITH ACTIDIONE ON THE EMERGENCE OF SPRING WHEAT AND ON ITS INFECTION BY SEED-BORNE COVERED SMUT FUNGI

Treatment	Concentration and form	Amount or time	Av % emergence	Av % smutted heads
Actidione	.5% dust	½ oz/bu	85.0	0.0
"	.5% "	1 " "	85.0	.0
"	1.0% "	½ " "	84.5	.6
"	1.0% "	1 " "	73.0	.0
"	10 ppm liquid	1 min	84.0	0.0
Clay diluent (ck)	Dust	1 oz	91.3	6.1
Aerosol-water (ck)	Liquid	1 min	91.3	8.3
None (ck)			90.7	22.9
LSD			7.9	

The above results of greenhouse experiments show that rapid seed treatment of wheat with actidione in both dust and liquid form gave complete or almost complete control of covered smut of wheat. Emergence appeared to be reduced slightly, but the reduction was significant from the emergence of the checks only with the highest dosage of the antibiotic in dust form. The entire effect in smut control cannot be attributed to the antibiotic, since it is evident from the check results that the diluents had considerable influence themselves in reducing the severity of the smut infection. This, however, may be considered an advantage of the treatments, especially in view of the fact that the diluents had no injurious effects on the seed. It will be noted that control of covered smut of wheat was obtained with actidione in highly diluted form and that the procedures followed in applying it were similar to those at present used in the treatment of wheat and other grains with standard fungicides. Moreover, field data which will soon be available tend to confirm in large measure the results of the greenhouse experiments given here. These will be reported in another paper.

Reference

1. HENRY, A. W., *et al. Science*, **113**, 390 (1951).

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An Improved Method for Measuring Coagulation Time

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Numerous methods for measuring the clotting time of blood have been proposed. The most satisfactory technique for the purpose, however, is the so-called Lee and White method (*1*). This consists in withdrawing blood from a vein, or in smaller animals directly from the heart, introducing 1 or 2 ml of the blood into flat-bottomed glass shells or homeopathic vials, and measuring the time it takes for the blood to clot as indicated by tilting the tubes every minute until the blood no longer flows.

We have recently devised an improvement in the Lee and White technique which we find very useful for careful research investigations. This consists in the employment of an instrument that enables the investigator to measure accurately the exact angle at which the surface film of the whole blood in the homeopathic vial is broken and begins to flow. The apparatus, which is made of plexiglass, consists of a vertical quadrant fixed on a plastic base (Fig. 1). At the center of the quadrant there is attached a radial pointer which carries at its base a small platform on which the vial containing the blood is placed. The quadrant is subdivided into degrees and half-degrees from 0 when the pointer is in a vertical position to 90° when it is in a horizontal position.

Blood is obtained from rabbits by direct cardiopuncture and immediately transferred to flat-bottomed vials 15 mm in diam and 45 mm in height. As soon as 1 or 2 ml of the blood is introduced into the perfectly clean vial the experimenter notes the posi-

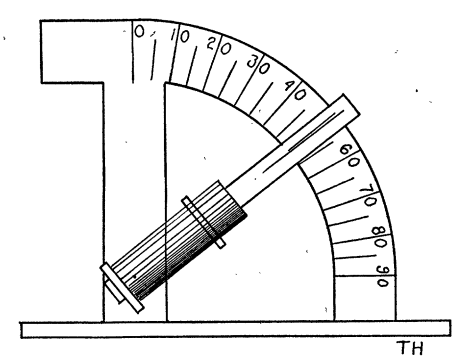

FIG. 1.

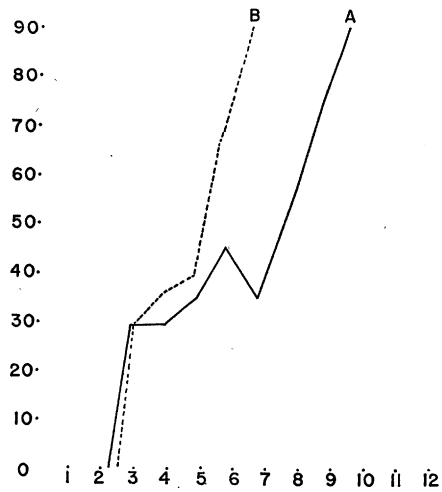

FIG. 2. Experiment on rabbit weighing 2.5 kg. Horizontal line indicates time in min; vertical line indicates angles at which blood surface film is broken. *A*, Normal clotting time, 10 min; *B*, 2 hr after parenteral injection of 2 mg diacetylmorphine; clotting time, 6 min. Note dip in normal curve after 6 min.

tion of the pointer in degrees of the quadrant every minute until the blood is completely clotted. That end point occurs when the radial pointer is in a horizontal position—in other words, at 90°.

It was found when using this instrument that the clotting process does not always proceed in a progressive manner. There are points when the film does not break so quickly, followed by a less resistant surface film. This is quite characteristic of normal blood. Furthermore, we found that the curve representing coagulation angles in relation to clotting times will vary with the thromboplastic or anticoagulating agents employed (Figs. 2, 3). This may eventually prove to be useful in analyzing the clotting mechanism after various drugs. For example, this instrument is

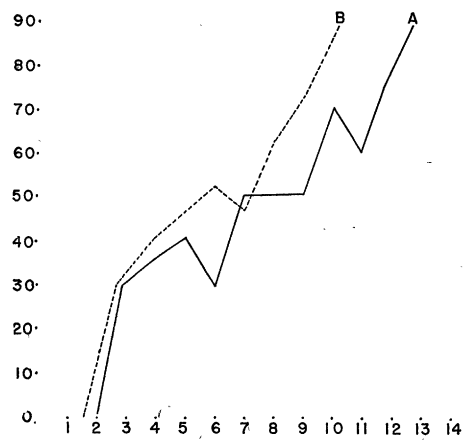

FIG. 3. Experiment on rabbit weighing 3.4 kg. Horizontal line indicates time in min; vertical line indicates angles at which blood surface film is broken. *A*, Normal clotting time, 13 min; *B*, 2 hr after injection of aureomycin; clotting time, 9.5 min. Note dips in normal curve after 6 and 11 min, and 1 dip in other curve after 7 min.

useful in following the effects of heparin when used to determine the imbalance of coagulating and anticoagulating factors in the blood (*2*); also the thromboplastic properties of penicillin (*3, 4*), mercurial diuretics (*5*), amphetamin (*6*), and other drugs.

The advantages of the above-described apparatus are obvious. We eliminate the personal equation involved in picking up the vial and tilting it at no precise angle, as well as shaking the specimen, all of which manipulations may produce appreciable variations in readings. In other words, this method enables the investigator to measure the clotting time more exactly and, at the same time, by plotting the relation curve between clotting time and clotting angle, it is helpful in analyzing the mechanism of the clotting process.

References

1. LEE, R. I., and WHITE, P. D. *Am. J. Med. Sci.*, **145**, 495 (1913).
2. DE TAKATS, G. A. *J. Am. Med. Assoc.*, **146**, 1372 (1951).
3. MODLAVSKY, L. F., HASSELBROOK, W. B., and CATENO, G. D. *Science*, **102**, 38 (1945).
4. MACHT, D. I. *Ibid.*, **105**, 213 (1947).
5. ———. *Am. Heart J.*, **31**, 460 (1946).
6. ———. *Arch. intern. pharmacodynamie* (in press).

Manuscript received August 27, 1951.

The Action of Ultraviolet Light on the Pentose Moiety of Nucleic Acids and Related Compounds[1]

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In the present work, the fate of the pentose moiety of nucleotides upon exposure to ultraviolet radiations was investigated. The fact that free carbohydrates undergo complex changes when subjected to ultraviolet light was verified in preliminary studies, in which 2×10^{-4} *M* solutions of glucose and ribose, buffered with phosphate at pH 7.4, were placed in 1-cm rectangular quartz cells and exposed to radiations from an unscreened quartz lamp at a distance of 5 cm from the center of the lamp. Within 60 min both sugars were rendered incapable of reducing the alkaline copper salt reagent of Benedict (*1*) and of giving a positive Molisch test. In addition, the irradiated ribose solution did not react to the *p*-bromoaniline acetate test (*2*), which depends upon the formation of furfural from free pentoses.

In similar experiments with dilute solutions (30 μg/ml) of adenylic acid, cytidylic acid, and yeast nucleic acid, the compounds lost the ability to form furfural within an exposure period of less than 90 min. Both unexposed and irradiated solutions were assayed for furfural-yielding capacity by a modified Reeves and Munro technique (*3*). Moreover, irradiated

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