for scientific personnel will continue to outstrip the supply. Military research will continue and universities must enlarge their faculties to fill the gap in training caused by the wartime lag; they are witnessing the beginning of an influx of foreign students. The demand by foreign countries for scientific and technical personnel is expected to be very great.

Despairing of bringing about a reversal of the administrative policy that has been responsible for the excessive drafting of irreplaceable personnel, leaders of science are turning their effort to legislative methods, Dr. Trytten reports. While most of the damage has already been done it is imperative that training in the physical sciences particularly be resumed immediately. Legislation in preparation would select 20,000 men a year for such training.

Dr. Reuben T. Shaw, chairman of the National Science Teachers Association's Committee on Public Relations, presided at the meeting. Dr. Philip G. Johnson, president of the association, described science education's job as two-fold: to supplant widespread scientific illiteracy with a basic scientific culture and to train technical workers for science and industry. He suggested that industrial advertisers who have been saluting the role of the teacher in education should call attention to the special importance of the science teacher.

Dr. Ivor Griffith, president, and Dr. Rachel Anderson, vice-president, of the Middle States Science Teachers Association, were among the speakers. Dr. Griffith, who also is president of the Philadelphia College of Pharmacy and Science, paid special tribute to the pharmaceutical industry for pre-war research that made possible the remarkable wartime developments in medicine, and for that industry's generous and timely support of science education.

The spokesman for industry was E. C. Fuller, president of the Curtis Publishing Company and former president of the National Association of Manufacturers. Mr. Fuller reported on surveys made by the NAM which clearly showed industry's large stake in better education. He cited the particular need for a public with an understanding of scientific principles.

Joseph F. Burke, educational director of the American Federation of Labor, spoke of labor's strong support for better educational opportunities. Also present was W. B. Woodward, Jr., of the Brotherhood of Locomotive Firemen and Enginemen.

Dr. Homer C. Will, president of the Pennsylvania Academy of Science; Dr. Bradford Willard, president-elect, and several members of the executive committee attended the meeting as well as Dr. Walter S. Lapp, president of the Philadelphia Science Teachers Association, and members of its executive committee.

Dr. William A. Feirer, vice-president of Sharpe and Dohme; Franklyn Waltman, public relations director of the Sun Oil Company; Roy Stryker, George Freyermuth and Barry Meglaughlin, of the Standard Oil Company of New Jersey; J. A. Lorimer and H. J. Druequer, of the Standard Oil Company of Pennsylvania, and H. R. Clark and A. F. Natters, of the Radio Corporation of America; James K. Hunt, public relations director of E. I. du Pont de Nemours and Company; and P. L. Schauble, vice-president (public relations) of the Bell Telephone Company of Pennsylvania, and W. M. Welch also were present.

Dr. Irving P. Reimann, director of the Lankenau Hospital Research Institute, represented the American Medical Association and spoke of the critical need for more science in the secondary school in the interest of public health. The American Legion was represented by Dr. Charles E. Sohl, the American Chemical Society by Dr. F. T. Tyson, Sigma Xi by Dr. James A. Harrison, the Physics Club of Philadelphia by Dr. M. R. Wehr, and various engineering societies by Dean J. H. Billings, of the Drexel Institute of Technology, Philip H. Spear and F. V. Westermaier.

SPECIAL ARTICLES

IN VITRO EVIDENCE OF REGENERATION OF ACTIVE PENICILLIN FROM PENICILLIN ESTERS

INDIRECT evidence for the existence of bacteriostatically inactive penicillin esters and their ability to hydrolyze to yield bacteriostatically active penicillin has been presented by Meyer, Hobby and coworkers.[1, 2] Their esters were prepared by the reaction of a diazoalkane with the acid form of penicillin in chloroform. Evidence for the regeneration of bacteriostatically active penicillin from the esters was deduced from experiments *in vivo*. These showed that mice inoculated with lethal doses of a hemolytic streptococcus were protected by oral or subcutaneous administration of solutions of the ethyl or n-butyl esters.

Direct evidence has been found which shows that penicillin esters may be converted to active penicillin *in vitro*.

The methyl ester of penicillin was prepared by addition of diazomethane[3] to 250 ml of an amyl acetate solution of the free acid of penicillin which assayed initially 5,990 International Units per ml. After re-

[1] K. Meyer, G. L. Hobby and E. Chaffee, SCIENCE, 97: 205–206, 1943.

[2] K. Meyer, G. L. Hobby and M. M. Dawson, *Proc. Soc. Exp. Biol. and Med.*, 53: 100–104, 1943.

frigerating for 24 hours, a cup plate assay against *Staphylococcus aureus* A.T.C.C. No. 6538 showed 12 I.U. per ml. After washing with 750 ml of 1 per cent. $NaHCO_3$ buffer adjusted to pH 7.8 followed by 300 ml of water, the assay of the amyl acetate solution was 30 I.U. per ml. The combined wash liquid assayed less than 5 I.U. per ml.

The resulting washed amyl acetate solution was concentrated at 30° C under vacuum to a yellow oil weighing 1.46 g. Theoretically, this oil should have a potential potency of about 1,000 I.U. per mg. It was dissolved in dry methanol to form 30 ml of solution. The theoretical potential potency of the solution was about 50,000 I.U. per ml.

Emulsions were prepared by adding the methanol solution of the ester to distilled water to which were added sodium bicarbonate and Duponol[4] as indicated in Table 1. These mixtures were held at 5° C and were assayed at intervals with the results as indicated in Table 1. The fact that the methyl ester of penicillin can be hydrolyzed *in vitro* to yield active penicillin is evident.

The ethyl ester of penicillin was prepared in the same manner as the preparation of the methyl ester, except that diazoethane[3] was employed as the esterifying agent and the yellow oil concentrate was dissolved in dry ethanol to make 30 ml of solution. This also should have a theoretical potential potency of about 50,000 I.U. per ml.

Suspensions of the ethyl ester were prepared and handled in the same manner as were those of the

TABLE 1

REGENERATION OF ACTIVE PENICILLIN FROM THE METHYL ESTER

Emulsion*	$NaHCO_3$ added mg	Duponol added mg	pH	Assay, I.U. per ml Day: 0	1	2	3	4	Maximum reactivation per cent. of theory
1	0	0	6.0	12	30	17	17	14	4.8
2	20	0	7.3	13	136	161	150	114	25.8
3	0	5	5.8	14	3	1	0.2	.2	2.2
4	20	5	7.1	18	73	119	117	105	19.0

* All emulsions were prepared by adding 0.25 ml of the methanol solution of the methyl ester to 19.75 ml of distilled water. The theoretical potential potency of the emulsion was about 625 I.U. per ml.

methyl ester. The fact that active penicillin may be regenerated by hydrolysis of this ester is shown in Table 2.

The emulsions were physically stable in the presence of Duponol or $NaHCO_3$ or both, but in the absence of these agents (emulsions 1 and 5) some of the oily material collected on the walls of the containing

[3] C. R. Noller, "Organic Syntheses," Vol. XV, pp. 3–5, New York: John Wiley and Sons, Inc. 1935. Diazoethane was prepared by the same general method.

TABLE 2

REGENERATION OF ACTIVE PENICILLIN FROM THE ETHYL ESTER

Emulsion*	$NaHCO_3$ added mg	Duponol added mg	pH	Assay, I.U. per ml Day: 0	1	2	3	4	Maximum reactivation per cent. of theory
5	0	0	6.2	7	6	8	7	6	1.3
6	20	0	7.2	10	34	98	100	66	16.0
7	0	5	6.0	9	1	0.3	.2	.2	1.4
8	20	5	7.3	10	33	59	55	42	9.5

*All emulsions were prepared by adding 0.25 ml of the ethanol solution of the ethyl ester to 19.75 ml of distilled water. The theoretical potential potency of the emulsion was about 625 I.U. per ml.

vessels. The emulsions became increasingly transparent on standing, particularly in the presence of $NaHCO_3$. Hydrolysis was indicated. Duponol[4] appears to exert an inactivating effect on penicillin.

Both the methyl and ethyl esters are slightly soluble in water with the methyl ester being the more soluble of the two. Data in Tables 1 and 2 show that the methyl ester is also the more readily hydrolyzed of the two esters. Methyl esters are generally formed and hydrolyzed more readily than esters of higher alcohols.[5]

Although the theoretical amount of active penicillin has not as yet been obtained from these bacteriostatically inactive esters, the fact that a significant fraction may be regenerated *in vitro* is of interest.

Summary: It has been found that methyl and ethyl esters of penicillin may be hydrolyzed *in vitro* to yield 26 and 16 per cent. respectively of the theoretical bacteriostatically active penicillin.

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THE EFFECT OF ULTRAVIOLET RADIATION ON CYSTS OF ENDAMOEBA HISTOLYTICA[1]

THE object of these experiments was to determine whether or not ultraviolet radiation is lethal to the cysts of the intestinal pathogen, *Endamoeba histolytica.*

Two models of ultraviolet lamps were supplied by the General Electric Company. Both lamps emitted energy of wave-length 2,537A, which lies within the region where the maximum germicidal effect might be expected.[2] Distilled water suspensions of the cysts,

[4] Duponol ME, E. I. du Pont de Nemours and Co., Wilmington, Del.

[5] A. Michael and K. Wolgast, *Ber.*, 42: 3157–3176, 1909.

[1] The material in this article should be construed only as the personal opinion of the writers and not as representing the opinion of the U. S. Navy Department.