equations of Wynne-Jones and Bjerrum are not applicable to this case.

Since this paper was submitted, R. M. Garrels and F. T. Gucker have published a valuable study of aqueous lead chloride solutions [*Chem. Rev.*, **44**, 117 (1949)]. These authors give considerable additional evidence for incomplete dissociation in such solutions, and derive values for K of about 0.03 from e.m.f. and conductance data.

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RECEIVED JANUARY 31, 1949

The Liberation of Diazotizable Amine from Pteroylglutamic Acid[1]

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During a study of the possible role of pteroylglutamic acid (PGA)[2] and *p*-aminobenzoic acid (*p*-ABA) on the inhibition by sulfonamides of the growth of *Lactobacillus arabinosus* strain 17-5 and other bacteria, certain inconsistancies have been observed by us. These inconsistencies suggested the possibility that pteroylglutamic acid was undergoing decomposition in the sterile medium. Certainly, if this were so, it would have considerable bearing on the interpretations of the results of physiological experiments with pteroylglutamic acid.

TABLE I

RATE OF THE DECOMPOSITION OF PTEROYLGLUTAMIC ACID (PGA)

Pteroylglutamic acid solutions[a]	μg *p*-ABA/1000 μg of PGA[c] 0 hr.	20 hr.	40 hr.	64 hr.	120 hr.	168 hr.
1 Distilled water brought to *p*H 7.0	1.62	3.00	3.91	6.36	9.09	11.82
2 *M*/30 phosphate buffer *p*H 7.3	1.72	2.73	4.27	6.36	9.54	12.36
3 *M*/30 Na_2HPO_4, *p*H 9.18	1.36	2.55	4.27	11.36	13.63	81.82
4 *M*/30 KH_2PO_4 *p*H 4.5[b]	1.36	2.18	2.72	3.36	4.32	5.45
5 Growth medium (*p*H 7.0) (used for *L. arabinosus*[3])	2.50	3.82	6.18	14.54	18.86	45.44
6 Medium as in (5) without PGA	0	0	0	0	0	0
7 1 μg *p*-ABA/ml. of *M*/30 phosphate buffer of *p*H 7.3	1	1	1	1	1	1

[a] All solutions were autoclaved for ten minutes at 10 lb. pressure. Systems 1 to 5 contained 500 μg of PGA/ml. The solutions were then kept in a constant temperature incubator at 30°. [b] Pteroylglutamic acid dissolves on autoclaving and a precipitate forms on cooling; determinations for *p*-ABA were made on uniform suspensions. [c] *p*-ABA content of the various systems were determined according to Bratton and Marshall[4] using Klett-Summerson photoelectric colorimeter with filter No. 54, 1 μg of *p*-ABA/10 ml. reaction system gives a colorimetric reading of 22.

The data presented in Table I pertain to this observation.

It can be seen from the table that PGA decomposes at a regular rate on incubation at 30°. A very great rate of decomposition occurs in the sterile medium which has been generally used for the growth of *Lactobacillus arabinosus* 17-5. In this medium, 6.18 to 14.54 μg. of diazotizable amine calculated as *p*-ABA per 1000 μg. of PGA are liberated during an incubation period of from forty to sixty-four hours. The diazotizable component liberated in this medium is significantly greater than the amounts liberated in either aqueous or neutral phosphate buffer solutions of PGA. These results indicate that certain substances in the sterile medium accelerate the decomposition of PGA. The nature of these substances is under investigation.

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RECEIVED MAY 16, 1949

Lithium Borohydride as a Reducing Agent

BY ROBERT F. NYSTROM, SAUL W. CHAIKIN AND WELDON G. BROWN

Lithium borohydride shares with lithium aluminum hydride the property of solubility in ether and other organic solvents. In ether solution it is a more powerful reducing agent than sodium borohydride (in water or alcohol solution) but is milder than lithium aluminum hydride. This combination of properties, together with the prospect of early commercial availability, suggests useful applications for lithium borohydride particularly in the execution of selective reductions.

Solid lithium borohydride has been known to flash on exposure to humid air, some samples being more prone than others, and for this reason transfers of the solid should be conducted in a dry atmosphere. However, solutions of lithium borohydride are relatively insensitive to moisture and in the experiments to be described no special precautions were taken to exclude moisture. Otherwise the procedures followed in lithium borohydride reductions were generally similar to those employed in reductions by lithium aluminum hydride. Tetrahydrofuran proved advantageous as a solvent, since more concentrated solutions of the hydride could be used, *viz.*, 3.5 *M* as compared with 0.5 *M* in diethyl ether.

The aldehydes and ketones (*cf.* Table I) were reduced rapidly at room temperature in exothermic reactions whereas the esters reacted slowly and the mixtures were heated to reflux for periods up to six hours. In the selective reduction of the ketone groups of the keto-esters, and of *m*-nitroacetophenone, ice-bath cooling was employed to enhance selectivity. The attempted selective reduction of ethyl acetoacetate gave rise to a borate complex from which the reduction product could not be

(1) This investigation was supported, in part, by a research grant from the Division of Research Grants and Fellowships of the National Institute of Health, U. S. Public Health Service.

(2) The authors are indebted to Dr. C. W. Waller, Lederle Laboratories, Pearl River, New York, for a freshly recrystallized sample of PGA. It contained 1 μg of *p*-ABA/1000 μg of PGA.

(3) T. D. Luckey, G. M. Briggs, Jr., and C. A. Elvehjem, *J. Biol. Chem.*, **152**, 157 (1944).

(4) A. C. Bratton and E. K. Marshall, Jr., *ibid.*, **128**, 537 (1939).