mycin, 0; dihydrostreptomycin hydrolyzate, 1.

The presence of at least two aldehyde groups and a terminal methyl group in the central moiety, $C_6H_8O_5<$, of streptomycin, together with the lack of chemical evidence for a hydroxyl group, indicates that this portion probably possesses two carbon chains linked in a polyacetal type of structure.

R. U. LEMIEUX
W. J. POLGLASE
C. W. DEWALT
M. L. WOLFROM
DEPARTMENT OF CHEMISTRY
THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO

RECEIVED NOVEMBER 20, 1946

THE ELECTRIC MOMENT OF *n*-BUTYLLITHIUM AND THE NATURE OF THE LITHIUM–CARBON BOND

Sir:

Despite the wide interest in the reactions of organolithium compounds, little information is available as to the nature of the metal–carbon bond in these compounds and conflicting opinions have been expressed. Thus, Morton,[1] in a recent review, has chosen to regard all organoalkali compounds as salts, although lithium alkyls and aryls are soluble in non-polar solvents, can be distilled, and conduct poorly in solution in zinc alkyls.[2] We have made some measurements of the molar polarizations of *n*-butyllithium in benzene solutions which provide information on this subject and report them here since the work was temporarily interrupted before it could be extended to include other solvents, other lithium compounds and experimental values of molecular refraction.

Using our value, 40, for the molar polarization of *n*-C_4H_9Li in benzene, and estimating a value of 1.0 for the atomic refraction of lithium, we calculate a value of $\mu = 0.97D$ for the dipole moment of *n*-butyllithium. This indicates that the Li–C bond must have considerable covalent character, since ion pairs would result in very much higher values of the molar polarization (*e. g.*, $P_\infty = 1309$ for $LiClO_4$, a largely polar compound, in dioxane solution[3]). From the electronegativity difference, 1.5 units,[4] between carbon and lithium, one would predict about 45% ionic character for the Li–C bond and a bond moment of about $1.5D$ (Malone's rule, ref. 4, p. 68). The observed bond moment is $1.37D$, assuming the C–H bond moment to be $0.4D$ and taking lithium as the positive end of dipole. Lithium alkyls may thus be regarded as covalent compounds, just as organic fluorine compounds are, the rather large amount of ionic character of the Li–C bond being about equal in magnitude to that of the C–F bond.

n-Butyllithium was prepared by stirring a benzene solution of *n*-butyl chloride with an excess of lithium sand for two days. The solution was filtered and transferred to the dielectric constant cell for measurement; the apparatus and technique have been described[5] previously. The density was determined, and aliquots withdrawn and analyzed acidimetrically. All handling was done in a carefully dried, all-glass apparatus, through which dry, oxygen-free nitrogen was continuously passed.

Solutions containing mole fractions 0.06685, 0.03055, and 0.02073 of *n*-butyllithium had densities 0.87098, 0.87035 and 0.87210, and dielectric constants 2.3371, 2.3000 and 2.2946. Extrapolation of the molar polarizations 36.8, 38.0, 39.3 to infinite dilution gave $P_2^\infty = 40.0$. Assuming the atomic refraction of lithium to be 1.0, MR_D was estimated to be 20.6 and μ is calculated to be $0.97\ D$.

---

(1) A. A. Morton, *Chem. Rev.*, **35**, 1 (1944).

(2) K. Ziegler, F. Crössmann, H. Kleiner and O. Schäfer, *Ann.*, **473**, 1 (1929); Hein, *et al.*, *Z. anorg. allgem. Chem.*, **141**, 161 (1924), and earlier papers.

(3) M. G. Malone and A. L. Ferguson, *J. Chem. Phys.*, **2**, 99 (1934).

(4) Linus Pauling, "Nature of the Chemical Bond," Cornell University Press, Ithaca, N. Y., 2nd ed., p. 64.

(5) Max T. Rogers and John D. Roberts, THIS JOURNAL, **68**, 843 (1946).

KEDZIE CHEMICAL LABORATORY
MICHIGAN STATE COLLEGE
EAST LANSING, MICHIGAN MAX T. ROGERS
CHEMISTRY DEPARTMENT
UNIVERSITY OF CALIFORNIA AT LOS ANGELES
LOS ANGELES 24, CALIFORNIA ARTHUR YOUNG

RECEIVED NOVEMBER 12, 1946

STUDY OF FERTILIZER UPTAKE USING P^{32}

Sir:

A small amount of P^{32} in the form of phosphoric acid was converted to ammonium phosphate and added to an aqueous solution of ammonium phosphate fertilizer. This was used in place of the usual fertilizer in a field experiment using wheat. The wheat was sown with fertilizer in a completely randonized plot on April 29th. The plants grew well and were harvested at intervals. On each occasion, five replicates, consisting of five plants each, were harvested.

The plants were ashed and the fertilizer uptake determined from the measured activity, making due allowance for sample thickness and the decay of P^{32}. The total phosphorus was measured chemically. The difference between the total phosphorus and fertilizer phosphorus gives the phosphorus taken up from the soil. The results are recorded, in part, in Table I.

TABLE I

	Date harvested			
	June 18	July 8	July 29	August 15
% P coming from fertilizer	19.1	13.4	10.8	6.7
% P from soil	80.9	86.6	89.2	93.3
% fertilizer taken up of the total added to the soil	12.9	21.3	23.7	23.6