(1-cyclopentenyl)-piperidine to produce a 74% yield of mixed 2,3,4,5,6,7- and 2,3,4,4a,5,6,-hexahydro-1-methyl-1H-1-pyrindine, b.p. 65–66° (6 mm.), confirmed by analysis (calcd. for $C_9H_{15}N$: C, 78.77; H, 11.02. Found: C, 78.71; H, 11.19) and by infrared absorption of the free base and of the perchlorate salt, m.p. 215–217°. Similarly, N-methyl-3-bromopropylamine hydrobromide reacts with 1-(1-cyclohexenyl)-piperidine to produce a 73% yield of mixed 1,2,3,4,5,6,7,8- and 1,2,3,4,4a,5,6,7-octahydro-1-methylquinoline, b.p. 82–84° (6 mm.), confirmed by infrared studies and by catalytic reduction to *cis*-1-methyldecahydroquinoline (picrate salt, m.p. 199–201°, reported m.p. 199–200°,[3] *anal.* calcd. for $C_{10}H_{19}N \cdot (NO_2)_3C_6H_2OH$: C, 50.25; H, 5.80. Found: C, 50.35; H, 5.71).

Further studies are under way to determine the scope of this reaction.

[3] M. Ehrenstein and W. Bunge, *Ber.*, **67**, 1715 (1934).

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SYNTHESIS OF ARYLDICHLOROBORANES

Sir:

We have found a simple and direct synthesis of aryldichloroboranes from boron trichloride and aromatic hydrocarbons.[1]

These halides were prepared by charging a stainless steel-lined pressure vessel (400 ml. internal capacity) with 100–125 g. of aromatic hydrocarbon, 2–30 g. of aluminum powder, 0.1 g. of aluminum chloride, iodine, or methyl iodide, and 60 g. of boron trichloride[2] and heating the vessel, under autogenous pressure and with agitation to 120–150° for 5–60 min. or to 30–50°[3] for 24–48 hours. The product, usually a liquid slurry, was filtered and the filtrate was distilled. In the case of benzene, the conversion to purified $C_6H_5BCl_2$ ranged from 60 to 72%, b.p. 95° (48 mm.). *Anal.* Calcd. for $C_6H_5BCl_2$: C, 45.38; H, 3.17; B, 6.79; Cl, 44.66. Found: C, 45.87; H, 3.54; B, 7.39; Cl, 44.31. Variations in the C_6H_6 to BCl_3 ratio had no significant effect on the nature of the products, and there was no evidence for the formation of $(C_6H_5)_2BCl$ or $C_6H_4(BCl_2)_2$. Polysubstitution in the aromatic nucleus undoubtedly is unfavorable because the strongly electronegative BCl_2 group deactivates the ring.[4]

Tolyldichloroborane was obtained from toluene in 60% conversions at 140°. Hydrolysis of the dichloride and cleavage of the B–C bond with hydrogen peroxide gave *p*- and *m*-cresol in a 3:2 molar ratio (infrared determination); no *o*-cresol was present in detectable quantities. When prepared at 35°, the ratio of *para* to *meta* isomers in tolyldichloroborane was about 4.6:1. The aryldichloroboranes formed from the isomeric xylenes at 35° were: *meta*, 3,5-xylyl- with trace amounts of 2,5-xylyl-; *ortho*, 3,4-xylyl-; and *para*, 2,5-xylyl-. Mesitylene at 140° gave largely 2,5-xylyldichloroborane (~15% yield) with a small amount of the 2,4- isomer. At 35°, mesitylene reacted to form traces of mesityldichloroborane. Durene was inactive at 140°. At 30°, naphthalene and also biphenyl appeared to give more than one type of arylboron derivative.

The distribution of isomers in this synthesis of arylboranes is comparable to that in Friedel–Craft reactions that are run in the presence of aluminum chloride.[5] Accordingly, it is suggested that the active species in this synthesis may be BCl_2^+ or $ArH \cdot BCl_2^+$. Such species would be stabilized by the formation of the $AlCl_4^-$ anion, and reaction of the cation complex with the active aluminum surface would then produce the $ArBCl_2$ compound. The aspect of reaction mechanism is being investigated.

[1] The classical methods for the preparation of aryldihaloboranes have been discussed in a recent review by M. F. Lappert, *Chem. Rev.*, **56**, 1049 (1956). E. Pace (*Atti Accad. Lincei*, **10**, 193 (1929)) reported the synthesis of $C_6H_5BCl_2$ from benzene and boron trichloride over palladium black at 500–600°. The Pace synthesis has been studied by W. L. Ruigh, *et al.* (WADC Technical Report 55-26, Parts III-IV (1956), P.B. Nos. 121,374 and 121,718. U. S. Dept. of Commerce, Washington, D. C.). They found that, with charcoal-supported palladium catalysts, the yields were variable, probably due to sensitivity of the catalyst to poisons.

[2] Boron tribromide and triiodide also proved operable, but boron trifluoride did not react under these conditions.

[3] In one experiment with benzene, an exothermic reaction set in at 3° and the internal temperature flashed to 120°. A 66% conversion to $C_6H_5BCl_2$ was obtained. Variations in reaction rate are attributed to variations in the activity of the aluminum surface.

[4] The BCl_2 group should be at least as effective as Cl in deactivating the ring, and chlorobenzene itself was found to be inert to the BCl_3–Al reagents at 50°.

[5] Aluminum chloride is a co-product in this synthesis of arylboron chlorides.

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ON THE MECHANISM OF FATTY ACID SYNTHESIS[1]

Sir:

Recently we have reported[2–3] that the first step in fatty acid synthesis is the carboxylation of acetyl CoA to malonyl CoA catalyzed by the biotin containing R_{1gc} fraction in the presence of ATP and Mn^{++}.

Malonyl CoA readily is converted to palmitate in the presence of R_{2gc} and TPNH.[2] This conversion can be followed spectrophotometrically or isotopically. The addition of acetyl CoA will significantly increase the rate and extent of synthesis of palmitate. Furthermore, a significant amount of C^{14}-acetyl CoA is incorporated into palmitate when unlabeled malonyl CoA is used (Table I). The amount of label introduced into palmitate corresponds to about one eighth of the total amount of "C_2 units" converted to palmitate (measured by TPNH oxidation). Unlabeled acetaldehyde does not reduce the amount of C^{14}-acetyl CoA incorporated into palmitate and acetaldehyde is not formed by the enzymic reduction of acetyl CoA by TPNH.[4] Not only acetyl CoA but also C^{14}-butyryl CoA and C^{14}-octanoyl CoA can be incorporated into palmitate in presence of malonyl CoA.

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[2] S. J. Wakil, THIS JOURNAL, **80**, 6465 (1958).

[3] S. J. Wakil and J. Ganguly, *Fed. Proc.*, **18**, 346 (1959).

[4] R. O. Brady, *Proc. Nat. Acad. Sci.*, **44**, 993 (1958).