tion in an aqueous 7.4% borax solution is given as $[\alpha]_{\mathrm{D}}$ 28.3°[7] and $[\alpha]^{26}_{\mathrm{D}}$ 28.5°.[5]

The acetyl derivative prepared by heating with acetic anhydride and sodium acetate had m. p. 123–123.5° (cor.) and $[\alpha]^{25}_{\mathrm{D}}$ 21.53° (*c*, 1.97) in chloroform. The hexaacetate of *d*-mannitol has been reported to have m. p. 122° $[\alpha]^{20}_{\mathrm{D}}$ 24.4° in chloroform[8] and m. p. 123.5–124.5°, $[\alpha]^{27}_{\mathrm{D}}$ 21.3° in chloroform.[5] A mixed m. p. with an authentic sample of mannitol hexaacetate gave no depression.

To determine in which part of the seed the mannitol was present, 680 g. of the whole seeds was separated into shells and kernels and each extracted as above. Mannitol could be isolated only from the shells.

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(7) E. Fischer, *Ber.*, **23**, 385 (1890).

(8) E. Pacsu and F. V. Rich, THIS JOURNAL, **55**, 2023 (1933).

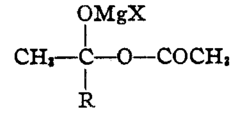
SCHOOL OF PHARMACY
UNIVERSITY OF WISCONSIN
MADISON, WISCONSIN RECEIVED NOVEMBER 13, 1944

The Preparation of Ketones from Grignard Reagents

BY MELVIN S. NEWMAN AND WILLIAM T. BOOTH, JR.

We have found that excellent yields of methyl ketones may be obtained by the addition of Grignard reagents to an ether solution of acetic anhydride at about −70°. Primary, secondary, tertiary aliphatic, and aromatic Grignard reagents give 70–79% yields of the corresponding methyl ketones while the allyl and benzyl reagents give 42 and 52%, respectively.[1]

We attribute the success of these reactions at low temperature to the thermal stability of the complex, I, formed by the addition of one molecule



$$CH_3-\underset{R}{\overset{OMgX}{C}}-O-COCH_3 \qquad \mathrm{I}$$

of Grignard reagent to one of the carbonyl groups of acetic anhydride, and to its decreased solubility. These factors both tend to reduce the further reaction of I with more Grignard reagent to form tertiary alcohol. At the low temperature involved there is probably no cleavage of this complex to form ketone which might further react.

The success of the above reactions led to the hope that good yields of ketones may be obtained also from acid chlorides and esters in a similar manner. These possibilities are being examined as well as the effect of low temperatures on other preferential Grignard reactions.

Experimental

In a typical experiment, 0.2 mole of a titrated Grignard reagent was added slowly during one hour to a stirred solution of 40 g. of acetic anhydride in 100 cc. of dry ether in a 500-cc. 3-necked flask cooled by a mixture of Dry Ice and acetone in a Dewar flask. The added reagent was cooled by dripping through a tube externally cooled with Dry Ice. After stirring for two to three hours the cooling bath was removed and the mixture was treated with ammonium chloride solution. After washing out the acetic anhydride and acid with alkali the ether was fractionated and the ketones distilled. For the most part the ketones were identified by boiling point and index of refraction, although a few derivatives were made. The following Grignard reagents gave the corresponding methyl ketones in the following yields: *n*-butylmagnesium chloride, 79%; *n*-butylmagnesium bromide, 79%; *s*-butylmagnesium bromide, 78%; *t*-butylmagnesium chloride; 77%; phenylmagnesium bromide, 70%; benzylmagnesium chloride, 52%; and allylmagnesium bromide, 42%. With phenylmagnesium bromide and propionic anhydride a 59% yield of propiophenone was obtained.

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(1) Fournier, *Bull. soc. chim.*, (3) **31**, 483 (1904); (3) **35**, 19 (1906); (4) **7**, 836 (1910), treated a series of primary halide Grignard reagents with a series of anhydrides at about −20° and reported general yields in the range 25–50%. We have found that on adding butylmagnesium bromide to acetic anhydride at −33° the yield of somewhat impure ketone is less than 40%.

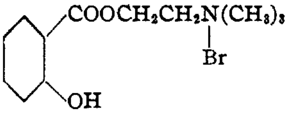
DEPARTMENT OF CHEMISTRY
OHIO STATE UNIVERSITY
COLUMBUS 10, OHIO RECEIVED SEPTEMBER 20, 1944

Some New Esters of Choline

BY M. WEIZMANN AND E. BOGRACHOV

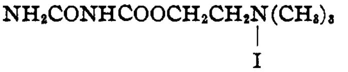
For a pharmacological and physiological study[1] esters of choline were required which were expected to be less easily saponified under biological conditions than acetyl-choline. To this end the derivatives of salicylic acid and of allophanic acid have been synthesized.

As the quaternary ammonium chlorides corresponding to acetyl-choline proved too hygroscopic, the bromides and iodides have been prepared. Salicyloyl chloride reacts with the hydroxyl group of trimethyl-(β-hydroxyethyl)-ammonium bromide and iodide in the normal way, and from the ester-bromide so obtained



the sulfate is prepared by interaction with silver sulfate.

For the preparation of the allophanic acid ester β-iodo-ethyl allophanate was prepared from ethylene iodohydrin and cyanic acid according to Béhal.[2] The halogenated ester was then treated with trimethylamine



$$NH_2CONHCOOCH_2CH_2\underset{I}{N}(CH_3)_3$$

Experimental

(1) Trimethyl-(β-hydroxy-ethyl)-ammonium Bromide (I).—Trimethylamine (75 g.) is added to a concentrated aqueous solution of ethylene bromohydrin (125 g.) at ice temperature. The mixture is kept overnight at below 5°, evaporated to dryness *in vacuo* and the residue recrystallized from alcohol; yield, 172 g. *Anal.* Calcd. for $C_5H_{14}ONBr$: C, 32.6; H, 7.6; N, 7.6. Found: C, 32.6; H, 7.6; N, 7.5.

The iodide (II) was prepared and recrystallized in the same way; yield, 94%. *Anal.* Calcd. for $C_5H_{14}ONI$: N, 6.1; I, 55.0. Found: N, 6.1; I, 54.9.

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(1) A. Schweitzer, M. Weizmann and S. Wright, *Cardiologia*, Vol. II, fasc. 4/5, 1938.

(2) Béhal. *Bull. soc. chim.*, [4] **25**, 477 (1919).