employed. A mixture of 22 g. of 2,4-dichlorobenzoic acid, 24 g. of *o*-nitroaniline, 17 g. of anhydrous potassium carbonate, 0.8 g. of copper bronze and 35 ml. of *n*-hexanol was heated under reflux with stirring for five hours. The mixture was steam-distilled, the residue was filtered, and the filtrate was acidified with 12 *N* hydrochloric acid. The precipitate obtained on acidification was collected and washed with water. Recrystallization of the moist product from ethanol–acetone gave 12.8 g. (35%) of bright orange crystals, m. p. 281°.

Anal. Calcd. for $C_{13}H_9ClN_2O_4$: C, 53.33; H, 3.08. Found: C, 53.22; H, 3.19.

4-Nitro-6-chloroacridone.—The substituted diphenylamine (5 g.) and 10 ml. of concentrated sulfuric acid were heated on the steam-bath for six hours.[3] The warm mixture was poured carefully down the wall of a 150-ml. beaker into 80 ml. of boiling water. The precipitate thus formed was boiled with dilute sodium carbonate solution, collected on a filter and washed with water. Recrystallization of the product from glacial acetic acid gave 3.75 g. (75%) of yellow powder, m. p. 312° (dec. at 321°).

Anal. Calcd. for $C_{13}H_7ClN_2O_3$: C, 56.82; H, 2.57. Found: C, 56.60; H, 2.71.

4-Nitro-6,9-dichloroacridine.—Ten grams of 5-chloro-2′-nitrodiphenylamine-2-carboxylic acid and 35 ml. of phosphorus oxychloride were heated with stirring for two hours at 135°. The mixture was poured onto 100 g. of ice and aqueous ammonia. The precipitate which formed was recrystallized from ethanolic ammonia solution to yield 8.5 g. (85%) of yellow powder, m. p. 205°. 4-Nitro-6,9-dichloroacridine was also prepared by treating 4-nitro-6-chloroacridone with a mixture of phosphorus pentachloride and phosphorus oxychloride. The product was found to be readily susceptible to hydrolysis, with regeneration of the acridone.

Anal. Calcd. for $C_{13}H_6Cl_2N_2O_2$: C, 53.23; H, 2.06. Found: C, 53.09; H, 2.26.

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[3] "Organic Syntheses," **19**, 6 (1939).

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Choline Cholanate

Pure cholanic acid (3.62 g.), prepared by Clemmensen reduction of 3,12-diketocholanic acid, was refluxed two and one-half hours with 25 cc. of thionyl chloride.

The crystalline acid chloride so obtained was treated according to a preparatory method of Fourneau and Page[1] with 5 cc. of β-iodoethanol.[2] The reactants were mixed and allowed to stand at room temperature for three hours with occasional warming in the water-bath to redissolve the crystalline mass. After this time the reaction mixture was taken up in ether and the ether layer washed at 0° successively with dilute sodium carbonate, hydrochloric acid and water until neutral. Evaporation of the dried ether solution produced an oily residue which crystallized on addition of a drop of methanol.

This ester residue was transferred to a combustion tube and 10 cc. of an 18.7% benzene solution of trimethylamine was added. The tube was closed and heated in an autoclave at 120° for twenty-two hours.

Dilution of the reaction mixture with 3 volumes of ether precipitated 1.3 g. of leafy brown material which for the most part was the choline iodide ester of cholanic acid contaminated with some trimethylamine hydroiodide. This reaction product was filtered and dissolved in water. To the clear water solution was added an excess of sodium picrate. The bases so precipitated were recrystallized from dilute methanol and after five recrystallizations the picrate of the choline ester was obtained as a pure product (needles), m. p. 194 (dec.) cor.

Anal. Calcd. for $C_{35}H_{54}N_4O_9$: C, 62.29; H, 8.07. Found: C, 62.18; H, 8.09.

The authors are indebted to Merck and Company, Rahway, New Jersey, for the micro-analyses.

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[1] E. Fourneau and H. J. Page, *Bull. soc. chim.*, [4] **15**, 544–553 (1914).

[2] Louis Henry, *Rec. trav. chim.*, **20**, 253 (1901).

[3] Research Associate, Rockefeller Foundation Fellow.

α-(Di-*n*-amylaminomethyl)-2-methoxy-1-naphthalenemethanol Hydrochloride

This compound[1] was prepared from the corresponding amino ketone by reduction with aluminum isopropoxide as described earlier.[2] The yield of crude α-(di-*n*-amylaminomethyl)-2-methoxy-1-naphthalenemethanol hydrochloride was 72% based on bromo ketone, but purification was difficult and the yield of analytically pure hydrochloride, m. p. 136.5–137.5° (cor.), was 33%.

Anal. Calcd. for $C_{23}H_{36}O_2NCl$: C, 70.11; H, 9.21. Found: C, 70.03; H, 9.13.

The solubility at 23.5° is 0.61 g. in 100 ml. of saturated aqueous solution.

The hydrochloride was crystallized from ethyl acetate and from dioxane. From the latter it was obtained with one molecule of solvent of crystallization.

Anal. Calcd. for $C_{23}H_{36}O_2NCl{\cdot}C_4H_8O_2$: C, 67.26; H, 9.20. Found: C, 67.27; H, 9.03.

The dioxane was removed by heating at 70° in a Fischer pistol for two days.

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[1] Under a contract recommended by the Committee on Medical Research between the Office of Scientific Research and Development and the University of California, Los Angeles. Its antimalarial activity will be found in "Survey of Antimalarial Drugs 1941–1945," Vol. II, Wiselogle, editor, J. W. Edwards, Ann Arbor, Michigan, 1946, p. 413.

[2] Jacobs, Winstein, Ralls, Robson, Henderson, Akawie, Florsheim, Seymour and Seil, *J. Org. Chem.*, **11**, 21 (1946).

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Preparation of *p*-Phenylphenacyl Iodide, and Redetermination of the Melting Points of Some Phenacyl Halides

For a comparative study with the corresponding chloride and bromide, ***p*-phenylphenacyl iodide** was prepared as follows: To a solution of 2.3 g. of *p*-phenylphenacyl chloride in 30 cc. of dry acetone was added a solution of 1.7 g. of anhydrous sodium iodide in 20 cc. of the same solvent. The precipitate of sodium chloride formed at once was separated by filtration and rinsed with dry acetone. The acetone solutions, after evaporation of the solvent, gave 3.2 g. of crude product (corresponding to the theoretical amount), with a yellow color and darkening quickly when exposed to the air. After treatment with active charcoal in ethanol and two recrystallizations from ethanol the compound was obtained in the form of almost colorless needles and stable in the air, melting sharply at 104.4°.

Anal.[1] Calcd. for $C_{14}H_{11}OI$: I, 39.42. Found: I, 39.63, 39.35.

The same substance is obtained by the same procedure starting with *p*-phenylphenacyl bromide, or boiling the chloride or bromide in alcohol with potassium iodide.

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[1] Micro-Carius, executed by Mr. H. W. Rzeppa in the Instituto Butantan, São Paulo.

For comparative purposes the melting points of some related compounds were redetermined. **p-Phenylphenacyl chloride**, reported to melt at 122–123°,[2] was obtained after many recrystallizations from ethanol as colorless needles melting sharply at 129.0°. Calcd. for $C_{14}H_{11}OCl$: Cl, 15.42. Found[1]: Cl, 15.40; 15.16. The melting points of the p-phenylphenacyl halides decrease consequently from the chloride to the bromide, m. p. 127.0°,[3] and iodide as in the series of the phenacyl halides.

Phenacyl chloride, reported as melting at 52–55°,[4] 54°,[5] 56.5°,[6] 57–58°,[7] 58–59°[8] and 59°,[9] was prepared according to the procedure of Korten and Scholl[8b]; treated in ethanol with active charcoal, crystallized from alcohol, distilled and finally recrystallized from carbon tetrachloride, it melts sharply at 56.5°.

Phenacyl iodide, reported to melt at 28,[10] 29.5–30[11] and 30°[12], was apparently never crystallized from a solvent, evidently being considered too soluble in common solvents for this purpose.[13] We obtained it in 95.4% yield by mixing solutions of phenacyl bromide and sodium iodide in dry acetone. The precipitate of sodium bromide, immediately formed, was separated and washed with dry acetone. The acetone solutions, *quickly* evaporated at room temperature, left as residue a reddish oil which was extracted with ether. The ethereal solutions, decolorized with sodium thiosulfate, dried with anhydrous sodium sulfate and *quickly* evaporated gave an oil that, poured over ice, crystallized immediately. This crude product treated with active charcoal in ethanol was recrystallized from very dilute alcohol using the following technique: The product is dissolved in a small amount of slightly heated ethanol, small pieces of ice added and the flask kept in ice water; the substance separates in crystalline form. By repeating this process a few times the phenacyl iodide was obtained in colorless crystals melting sharply at 34.4°.

Anal. Calcd. for C_8H_7OI: I, 51.58. Found[1]: I, 51.68, 51.81.

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RECEIVED MARCH 1, 1947

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[2] A. Collet, *Bull. soc. chim.*, [3] **17**, 510 (1897); S. L. Silver and A. Lowy, THIS JOURNAL, **56**, 2430 (1934).

[3] Crystallized first many times from ethanol (m. p. 125°) and then twice from carbon tetrachloride. Reported melting points are 125.5°, N. L. Drake and J. Bronitsky, THIS JOURNAL, **52**, 3719 (1930), and 126–127°, B. R. Carpenter and E. E. Turner, *J. Chem. Soc.*, 869 (1934).

[4] Ch. St. Gibson, J. D. A. Johnson and D. C. Vining, *Rec. trav. chim.*, **49**, 1006 (1930).

[5] N. Puschin and K. S. Hrustanivic, *Ber.*, **71**, 798 (1938).

[6] A. P. J. Hoogeveen, *Rec. trav. chim.*, **50**, 669 (1931).

[7] A. Collet, *Bull. soc. chim.*, [3] **17**, 506 (1897).

[8] (a) W. Staedel, *Ber.*, **10**, 1830 (1877); (b) H. Korten and R. Scholl, *ibid.*, **34**, 1902 (1901); (c) D. A. Clibbens and M. Nierenstein, *J. Chem. Soc.*, **107**, 1492 (1915).

[9] F. Tutin, *ibid.*, **97**, 2500 (1910).

[10] A. Lucas, *Ber.*, **32**, 601 (1899).

[11] A. Collet, *Compt. rend.*, **128**, 312 (1899).

[12] J. U. Nef, *Ann.*, **308**, 294 (1899).

[13] C. Paal and H. Stern, *Ber.*, **32**, 532 (1899).

COMMUNICATIONS TO THE EDITOR

QUINOLIZIDINE

Sir:

Recently it became of interest to us to find a simple and convenient method of preparing quinolizidine (norlupinane) and various related compounds. It was found that diethyl β-(2-pyridyl)-ethylmalonate, prepared by the Michael addition of diethyl malonate to 2-vinylpyridine, could be hydrogenated directly to quinolizidine in 65% yield.

The addition of various nucleophilic reagents to 2-vinylpyridine was recently reported to THIS JOURNAL in an interesting article by Doering and Weil.[1] Our experiments on the addition of diethyl malonate to 2-vinylpyridine, which were carried out independently and prior to their publication, are in good agreement with their results. When 2-vinylpyridine was treated with an excess of diethyl malonate, there was obtained yields of 42 to 43% of diethyl β-(2-pyridyl)-ethylmalonate; b. p. 162–164° at 2 mm. *Anal.* Calcd. for $C_{14}H_{19}O_4N$: C, 63.38; H, 7.22; N, 5.28. Found: C, 63.35; H, 7.26; N, 5.27. When diethyl malonate and 2-vinylpyridine were employed in equivalent amounts, the major product was a high-boiling viscous oil whose composition as indicated by analysis of the picrate, is presumed to be diethyl di-(β-(2-pyridyl)-ethyl)-malonate. *Anal.* Calcd. for $C_{33}H_{32}O_{18}N_8$: C, 47.77; H, 3.89. Found: C, 47.95; H, 3.77.

Catalytic reduction of diethyl β-(2-pyridyl)-ethylmalonate using copper chromite as catalyst at 250° gave a 65% yield of quinolizidine; b. p. 84° at 21 mm.[2]; $n^{20.2}D$ 1.4796. The quinolizidine was identified through formation of its picrate[2]; m. p. 198–199°; methiodide,[2] dec. 309–311° (*Anal.* Calcd. for $C_{10}H_{20}NI$: C, 42.71; H, 7.17. Found: C, 42.50; H, 7.09); and hydrochloride, indefinite m. p. (*Anal.* Calcd. for $C_9H_{18}NCl$: C, 61.53; H, 10.32. Found: C, 61.20; H, 10.01). Catalytic reduction of diethyl β-(2-pyridyl)-ethylmalonate using Raney Ni at 140° gave 3-carbethoxy-4-ketoquinolizidine in 90% yield; b. p. 149° at 0.15 mm. *Anal.* Calcd. for $C_{12}H_{19}O_3N$: C, 63.97; H, 8.50; N, 6.22. Found: C, 63.92 H, 8.47; N, 5.97. The structure of the 3-carbethoxy-4-ketoquinolizidine was established by its conversion, via hydrolysis and decarboxylation, to 4-ketoquinolizidine (α-norlupinone). The 4-ketoquinolizidine formed a hydrochloride, m. p.

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[1] W. E. Doering and R. A. N. Weil, THIS JOURNAL, **69**, 2461 (1947).

[2] The following physical constants have been recorded for quinolizidine and its derivatives. Prelog and Bozicevic (*Ber.*, **72**, 1103 (1939)) give b. p. 69–70° at 11 mm.; picrate, m. p. 196°; methiodide, dec. 333°. Clemo, Ramage and Raper (*J. Chem. Soc.*, 2959 (1932)) give b. p. 72° at 16 mm.; picrate 194°; methiodide, dec. 335°. Galinovsky and Stern (*Ber.*, **76**, 1034 (1943)) give 70° at 10 mm.; picrate, m. p. 199–200°; and methiodide, dec. 333°.