

Nuchar W, filtered, and acidified with glacial acetic acid. The precipitate was collected on a Büchner funnel, washed with water and dried. The yellowish-brown crystalline powder weighed 1.4 g. It did not melt up to 380°.

Anal. Calcd. for $C_8H_4O_2N_2Cl$: N, 28.06; Cl, 14.20. Found: N, 28.00, 27.95; Cl, 14.21.

J. T. BAKER CHEMICAL CO.
PHILLIPSBURG, NEW JERSEY

RECEIVED NOVEMBER 15, 1948

NEW COMPOUNDS

Quinazoline Derivatives

4-(1,2,3,4-Tetrahydroquinolyl-1)-quinazoline.—Ten grams (0.0685 mole) of 4-quinazolone was refluxed with 22 g. (0.105 mole) of phosphorus pentachloride and 100 ml. phosphorus oxychloride for twenty-four hours. The latter was removed by distillation under diminished pressure; toluene (15 ml.) was added and 10 ml. removed by distillation. Twenty grams (0.139 mole) of 1,2,3,4-tetrahydroquinoline was added and the resulting mixture refluxed for two hours. Dilute hydrochloric acid was added and the upper layer separated and discarded. The addition of dilute sodium hydroxide to the aqueous layer resulted in the separation of a pasty solid. From this the desired product was obtained as bright yellow crystals from ethanol in a yield of 78%; m. p. 130.5–131.5°.

Anal. Calcd. for $C_{17}H_{15}N_3$: C, 78.14; H, 5.79; N, 16.08. Found: C, 77.80; H, 5.74; N, 16.15.

6-Chloro-4-(6-methoxy-1,2,3,4-tetrahydroquinolyl-1)-quinazoline.—In an analogous manner, 10.8 g. (0.060 mole) of 6-chloro-4-quinazolone, 12.7 g. (0.061 mole) of phosphorus pentachloride, 72 ml. phosphorus oxychloride, and 24 g. (0.15 mole) of 6-methoxy-1,2,3,4-tetrahydroquinoline were allowed to react to form the desired quinazoline in a yield of 68%. The product crystallized from an ethanol-ethyl acetate mixture in pale yellow needles, m. p. 106–108°.

Anal. Calcd. for $C_{18}H_{15}ClN_3O$: C, 66.35; H, 4.95. Found: C, 66.15; H, 4.95.

THE VENABLE CHEMICAL LABORATORY
UNIVERSITY OF NORTH CAROLINA GORDON M. GOODALE
CHAPEL HILL, N. C. ROBT. L. MCKEE

RECEIVED JANUARY 26, 1949

Two New Derivatives of 2-Aminofluorene

In an attempt to make 2-aminofluorene derivatives which should produce a more rapid carcinogenic response than that elicited by feeding *N*-(2-fluorenyl)-acetamide¹ we have prepared *N*-(2-fluorenyl)-glycine and *N*-(2-fluorenyl)-hemi-succinamide in the hope that the greater solubility of these compounds in water would lead to the desired action.

***N*-(2-Fluorenyl)-glycine.**—A solution of 36.2 g. (0.20 mole) of 2-aminofluorene² in 750 ml. of hot 95% ethanol was added to a solution of 29.2 g. (0.21 mole) of bromoacetic acid (Eastman Kodak Co.) and 38.8 g. (0.46 mole) of sodium bicarbonate in 500 ml. of water, the mixture heated under reflux on the steam-bath for twelve hours and then diluted with 500 ml. of boiling water. A small insoluble residue in the hot solution was removed by filtration, and the filtrate evaporated to a volume of 800

(1) Wilson, DeEds and Cox, *Cancer Research*, **1**, 596 (1941), and numerous papers by other authors since.

(2) "Organic Syntheses," Coll. Vol. II, New York, N. Y., 1943, p. 448. We have also reduced 2-nitrofluorene conveniently on the large scale with sodium hydrosulfite.

ml. in vacuum. When cold, it was acidified to pH 4 with 6 *N* HCl, and the amorphous brown powder that formed was filtered by suction and washed with 500 ml. of hot water. The crude fluorenylglycine was recrystallized from hot 95% ethanol (with decolorizing carbon (Darco)). After two further recrystallizations from the same solvent the compound was obtained in the form of small rhombic plates with a slight tan coloration; m. p. 157° (dec.) (uncor.); yield, 39 g. (81%).

Anal. Calcd. for $C_{15}H_{13}O_2N$: C, 75.3; H, 5.5. Found: C, 74.8; H, 5.4.

***N*-(2-Fluorenyl)-hemi-succinamide.**—A mixture of 36.2 g. (0.20 mole) of 2-aminofluorene² and 24 g. (0.24 mole) of succinic anhydride (E. K.) in 500 ml. of dry benzene was refluxed for seven hours, during which time the succinyl derivative slowly separated from the solution. When cold, the crude product was filtered off and the excess succinic anhydride present in it decomposed by suspending the material in 500 ml. of absolute ethanol and refluxing on the steam-bath for one hour. After twenty-four hours in the cold the pale yellow crystals were collected on a Buchner funnel and washed with 30 ml. of absolute ethanol. The yield of *N*-(2-fluorenyl)-hemi-succinamide, m. p. 225° (dec.) (uncor.) was 57.5 g. (95%). It formed colorless rhombic plates from acetone, m. p. unchanged.

Anal. Calcd. for $C_{17}H_{15}O_3N$: C, 72.6; H, 5.4; N, 5.0. Found: C, 72.6; H, 5.4; N, 5.0.

Dr. Gray H. Twombly, of the Department of Obstetrics and Gynecology of this University, has found that both these compounds are carcinogenically potent in rats.³

(3) Private communication.

DEPARTMENT OF BIOCHEMISTRY
COLLEGE OF PHYSICIANS AND SURGEONS
COLUMBIA UNIVERSITY
630 WEST 163RD STREET
NEW YORK 32, N. Y.

C. H. W. HIRS

RECEIVED JANUARY 31, 1949

p-Cyclopentylacetophenone and *p*-Cyclopentylbenzoic Acid

***p*-Cyclopentylacetophenone.**—Six grams of phenylcyclopentane and 3 g. of acetyl chloride were dissolved in 30 ml. of dry carbon disulfide and 5 g. of aluminum chloride was added gradually. A vigorous reaction ensued, the solution turning orange in color. The mixture was allowed to stand overnight. It was then refluxed for thirty minutes and poured upon ice and dilute hydrochloric acid. The organic layer was washed with water, dried over calcium chloride, and the solvent distilled at ordinary pressure. The residual oil was vacuum distilled. There was obtained 5 g. of a colorless, refractive oil which distilled at 131–135° at 6 mm. When freshly distilled, the product is practically odorless; d_{25}^{25} 1.028, n_D^{25} 1.5486; M_D calcd. 56.50; M_D observed 58.14.

Anal. Calcd. for $C_{13}H_{16}O$: C, 84.0; H, 7.96. Found: C, 84.1; H, 7.76.

2,4-Dinitrophenylhydrazone.—This derivative was prepared by the method of Shriner and Fuson.¹ It was obtained as bright orange plates, moderately soluble in alcohol from which it was twice recrystallized; m. p. 165°.

Anal. Calcd. for $C_{12}H_{10}O_4N_4$: C, 62.0; H, 5.43; N, 15.2. Found: C, 61.7; H, 5.39; N, 15.2.

***p*-Cyclopentylbenzoic acid** was prepared from *p*-bromophenylcyclopentane² by means of the Grignard reaction followed by carbonation with Dry Ice. The crude acid was twice recrystallized from dilute alcohol. From 2 g. of

(1) Shriner and Fuson, "Systematic Identification of Organic Compounds," 3rd ed., John Wiley and Sons, Inc., New York, N. Y. 1948, p. 171.

(2) Kleene, *THIS JOURNAL*, **62**, 2883 (1940).

starting material there was obtained 0.5 g. of the acid; colorless plates melting at 197°.

Anal. Calcd. for $C_{12}H_{14}O_2$: C, 75.8; H, 7.37. Found: C, 75.9; H, 7.31.

p-Cyclopentylbenzamide was prepared by the method of reference 1, p. 157. It was recrystallized from dilute alcohol and formed glistening flakes, m. p. 189–190°.

Anal. Calcd. for $C_{12}H_{13}ON$: C, 76.2; H, 7.94; N, 7.41. Found: C, 76.1; H, 8.12; N, 7.30.

The melting points given are uncorrected.

2211 BURLING STREET
CHICAGO 14, ILLINOIS

RICHARD D. KLEENE

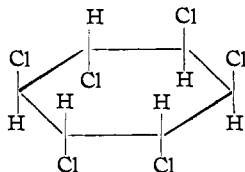
RECEIVED JANUARY 4, 1949

COMMUNICATIONS TO THE EDITOR

THE STRUCTURE OF α -BENZENE HEXACHLORIDE

Sir:

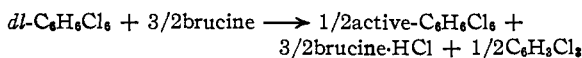
The structures of the isomers of benzene hexachloride (1,2,3,4,5,6-hexachlorocyclohexane) are of considerable interest due to the insecticidal activity of one of them.¹ Of the five known isomers, one, the β -isomer, is of established configuration,² being the isomer with all vicinal chlorine (or hydrogen) atoms *trans* to each other. The α -isomer has been assigned the structure



by Burrage and Slade¹ on the basis of a statistical treatment of chlorine addition, whereas Melander³ has assigned the above structure to the γ -isomer on the basis of dipole moment data.

We wish to report preliminary data at this time regarding the structure of the α -isomer.

The above structure has no element of symmetry and should therefore exist as a racemate capable of resolution.⁴ Lucas and Gould⁵ have shown that *dl*-dibromoalkanes may be partially resolved by preferred reaction of one modification with optically active bases. With this rate method we have obtained optically active α -benzene hexachloride by the reaction



The α , γ and δ isomers were treated separately in dioxane with one-half of the amount of brucine required for complete dehydrochlorination. Five grams (0.018 mole) of each isomer, 12.4 g. (0.027

(1) Slade, *Chemistry and Industry*, 314 (1945).

(2) Hendricks and Billicke, *THIS JOURNAL*, **48**, 3007 (1926); Dickinson and Billicke, *ibid.*, **50**, 764 (1928).

(3) Melander, *Svensk Kem. Tid.*, **58**, 231 (1946).

(4) The only structure for a hexachlorocyclohexane capable of resolution. See Shriner, Adams and Marvel in Gilman, "Organic Chemistry," John Wiley and Sons, New York, N. Y., 1943, 2nd ed., pp. 324, 337.

(5) Lucas and Gould, *THIS JOURNAL*, **64**, 601 (1942).

mole) of brucine, and 50 ml. of dioxane were allowed to stand at room temperature for several days. The alkaloid and alkaloid hydrochloride were removed by washing with water and dilute acid, and the residual (ether extraction) oily solids tested for optical activity. (Specific rotations (ethereal solutions): α , -14.6° ; γ , -0.1° ; δ , -1.3° .)

The optical activity of the α -product was concentrated by distillation, steam distillation, chromatography on alumina, and fractional distillation to give material of m. p. 128–132° (specific rotation over 120° (in acetone)). [*Anal.* calcd. for $C_6H_6Cl_6$: C, 24.78; H, 2.08; Cl, 73.14. Found (Clark Microanalytical Laboratories): C, 24.94; H, 2.32; Cl, 73.04. Hydrolyzable chlorine, calcd., 36.6; found, 36.2.] The activity is unaffected by recrystallization from concd. nitric acid, and is lost in a few minutes upon treatment with 2.5% methanolic sodium hydroxide.⁶

We are presently attempting the isolation of the levorotatory α -isomer with other optically active bases for a study of the phase diagram, as our present preliminary data suggest that the inactive material is a racemic compound.

We wish to acknowledge the assistance of the Office of Naval Research, for partial support of this work, as well as of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, where initial phases of this research were done.

(6) Cf. Cristol, *ibid.*, **69**, 338 (1947).

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF COLORADO
BOULDER, COLORADO

STANLEY J. CRISTOL

RECEIVED MARCH 11, 1949

THE EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF CERUM IN NITRIC ACID SOLUTIONS¹

Sir:

We have studied the exchange reaction between cerous and ceric ions in nitric acid solutions

(1) This work was carried out under the auspices of the Atomic Energy Commission.