

tion spectra to the remarkably short limit of 1565 Å. using *n*-perfluoroöctane as a solvent.³

The fluoro spectrum is peculiarly free of any visible vibrational structure. The 3100 cm.⁻¹ blue shift of the *N* → *V* transition on complete fluorination is to be compared with a blue shift of 500 cm.⁻¹ in para-fluorotoluene with respect to toluene itself. This seems to indicate a shift of about 500 cm.⁻¹ per *F*. Spectra being determined on di- and tri-fluoro derivatives will indicate whether this result holds for the intermediate cases. These blue shifts are probably related to the high ionization potential of atomic fluorine, higher than that of any other combining element, and may represent increased ionization potential of the ring system with increased fluorine substitution.

Further detailed analyses of these and other fluorine-substituted benzenes are under way. It is hoped that a tetrafluoro- and a hexafluoro-benzene will soon become available.

(3) H. B. Klevens and J. R. Platt, *J. Chem. Phys.*, **16**, Nov. (1948).

DEPARTMENT OF AGRICULTURAL BIOCHEMISTRY
UNIVERSITY OF MINNESOTA
ST. PAUL, MINN., AND
DEPARTMENT OF PHYSICS
UNIVERSITY OF CHICAGO
CHICAGO, ILL.

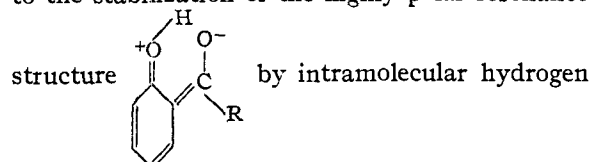
H. B. KLEVENS
J. R. PLATT
LOIS E. JACOBS

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MOLAR REFRACTION AND HYDROGEN BONDING

Sir:

The exaltations, 0.6 and 0.8 ml., observed in the molar refractions (D line) of salicylaldehyde and *o*-hydroxyacetophenone have been attributed¹ to the stabilization of the highly polar resonance




bonding. This stabilization increases the mobility of the π electrons and thereby increases the polarizability of the molecules.

It occurred to the authors that similar exaltations should be observed in hydrogen bonding solvents for compounds having electron releasing and electron attracting groups at the ends of conjugated chains. The highly polar structure $R_2N^+=C_6H_4=CHO^-$ contributing to *p*-dimethylaminobenzaldehyde, for example, should be stabilized preferentially by solvent molecules having positive hydrogen atoms. These exaltations have been observed. The molar refraction obtained for this compound in benzene, 51.4 ml., is increased by 1.7 ml. in chloroform and 2.9 ml. in alcohol. Somewhat smaller exaltations have been observed in chloroform and alcohol for anisaldehyde and *p*-nitroanisole.

It was anticipated that the highly polar struc-

(1) Curran, *THIS JOURNAL*, **67**, 1835 (1945).

ture $H_2N^+=C_6H_4=C-O^-$ contributing to *p*-amino-



acetophenone would be stabilized in alcohol to a greater extent than in dioxane, as the former solvent can form hydrogen bonds with both the amino hydrogens and the carbonyl oxygen. The molar refraction of this compound was observed to increase from 44.3 in dioxane to 45.87 in ethyl alcohol. A similar increase was observed for *p*-nitroaniline.

The molar refraction of diethyl ketone in benzene, 25.12, increases only to 25.22 and 25.21 in chloroform and ethyl alcohol, indicating that hydrogen bonding does not result in any significant increase in polarizability for molecules that are not stabilized by the contribution of highly polar resonance structures.

This research is being continued to study the relative effects of various terminal groups, of double and triple bonds in the conjugated chain, and of mixed solvents on this exaltation.

CHEMICAL LABORATORIES
UNIVERSITY OF NOTRE DAME
NOTRE DAME, INDIANA

F. M. PALERMITI
COLUMBA CURRAN

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THE ISOLATION OF A SUBSTANCE WITH Rh HAPTEN ACTIVITY

Sir:

It has been reported by Carter¹ that ether extraction of Rh-positive red blood cells produced a crude extract containing Rh hapten. We have been able to isolate from such extracts of pooled (A, B, AB and O) Rh-positive human cells a crystalline compound, m. p. 156.9–157.2°, having activity in dilutions of 1:5000 as measured by complement-fixation with anti-Rh₀ serum.^{1c,2}

Crude extract³ prepared according to Mrs. Carter's directions^{1a} was freed of phospholipids (ca. 25–50% of the material) by precipitation from ether with acetone and the soluble portion was chromatographed from pentane saturated with 95% methanol on silica gel impregnated with the same solvent. A number of fractions containing crude cholesterol were obtained followed by fractions which yielded glistening needles by recrystallization from ether–pentane or chloroform–pentane solution, m. p. 156.9–157.2°. From 979 mg. of crude extract, 80 mg. of the pure hapten was obtained.

(1) (a) Carter, *Am. J. Clinical Path.*, **17**, 646 (1947); (b) Carter, *Am. J. Obst. and Gynecology*, **55**, 1051 (1948); (c) Carter, *J. Immunology*, in press.

(2) We are very grateful to Mrs. Bettina Carter, of the Institute of Pathology, Western Pennsylvania Hospital, Pittsburgh, Pa., for carrying out the assay of Rh activity by complement fixation according to Kolmer (Kolmer and Boerner, "Approved Laboratory Techniques," 4th ed., D. Appleton-Century, New York, N. Y., 1945, p. 674).

(3) We are indebted to Dr. E. D. Campbell and H. J. Henry of Eli Lilly and Company for several samples of crude extract and to Dr. C. S. Culbertson, South Bend Medical Foundation, and Dr. S. O. Levinson, Michael Reese Research Foundation, Chicago, for samples of blood cells.