duce measurable quenching.[10] If accurate values of rate constants are to be obtained in such systems, Stern–Volmer quenching studies will have to be interpreted very carefully.

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Optically Active Aromatic Chromophores. VII.[1] Evidence for the Optically Active ^1L_a Transition

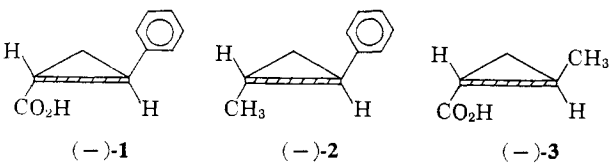
Sir:

Monosubstituted benzene rings exhibit three major transitions in the accessible isotropic absorption region: a weak band termed ^1L_b in the Platt notation[2] in the 255–275-nm region corresponding to a symmetry-forbidden $\pi-\pi^*$ transition, and two stronger bands near 210 and 185 nm. The 210-nm band, classified ^1L_a, is also forbidden but probably involves a contribution from the first allowed $\pi-\pi^*$ transition which overlaps it at shorter wavelength.[3] Upon appropriate ring substitution both of these latter bands may shift to longer wavelength.

Although the question of whether the ^1L_b transition of a monosubstituted benzene ring is optically active has been answered,[4] conflicting reports exist in the recent literature concerning the origin of a Cotton effect found in the 215–225-nm region of several benzene derivatives. For example, a band in this region which we have observed[5] in the CD spectra of several α-amino and α-hydroxy aromatic acids has been stated[6] to be due to the carboxyl chromophore and not to a transition involving the phenyl ring. In contrast to this, Rosenberg[7] concluded on the basis of ORD comparisons of phenylalaninol and tyrosinol with the corresponding amino acids that the ^1L_a transition of the phenyl ring is indeed optically active.

In this communication we present evidence for the direct observation of the optically active ^1L_a transition.

The compounds chosen for this ultraviolet and CD investigation were a series of structurally related cyclopropane derivatives of established absolute configuration:[8] (−)-(1*R*,2*R*)-*trans*-2-phenylcyclopropanecarboxylic acid, (−)-**1**; (−)-(1*R*,2*R*)-*trans*-1-methyl-2-phenylcyclopropane, (−)-**2**, and (−)-(1*R*,2*R*)-*trans*-2-methylcyclopropanecarboxylic acid, (−)-**3**. This series possesses the advantage that the substituents vary in such a way that the electronic effect of the three-membered ring should be a constant factor.



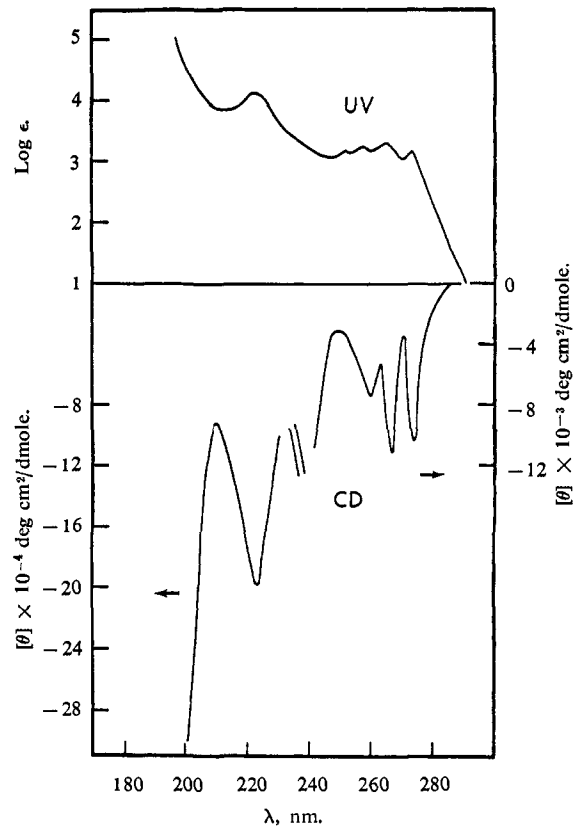


Figure 1. Ultraviolet and CD spectra of (−)-(1*R*,2*R*)-*trans*-2-phenylcyclopropanecarboxylic acid, (−)-**1**, in methanol solution. See ref 9 for explanation of the ordinate scales.

The ultraviolet and CD spectra of (−)-**1** in methanol solution are shown in Figure 1.[9,10] The isotropic absorption spectrum (upper curve) exhibits the typical vibrational structure of the ^1L_b band in the 250–275-nm region as well as a peak at 222 nm. The CD spectrum (lower curve) of (−)-**1** possesses negative Cotton effects corresponding to these peaks. The presence of the optically active carboxyl group makes the assignment of the 222-nm Cotton effect to the ^1L_a transition of the phenyl ring equivocal since the absorption band of the carboxyl chromophore occurs in a spectral region (206 nm for cyclopropanecarboxylic acid) close to that of the ^1L_a transition. It is well established that two overlapping Cotton effects give a resultant

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(9) Because of the relative weakness of the Cotton effect in the 260-nm region, the CD curve (*which is continuous*) was divided into two parts: the right-hand ordinate refers to the longer wavelength Cotton effect and the left-hand ordinate refers to the bands below *ca.* 240 nm. The log ε scale refers to the isotropic absorption spectrum.
(10) The CD spectra were measured using a JASCO Model ORD/UV/CD-5 spectropolarimeter with CD recorder operating under the conditions described in L. Verbit, *J. Am. Chem. Soc.*, **89**, 167 (1967).

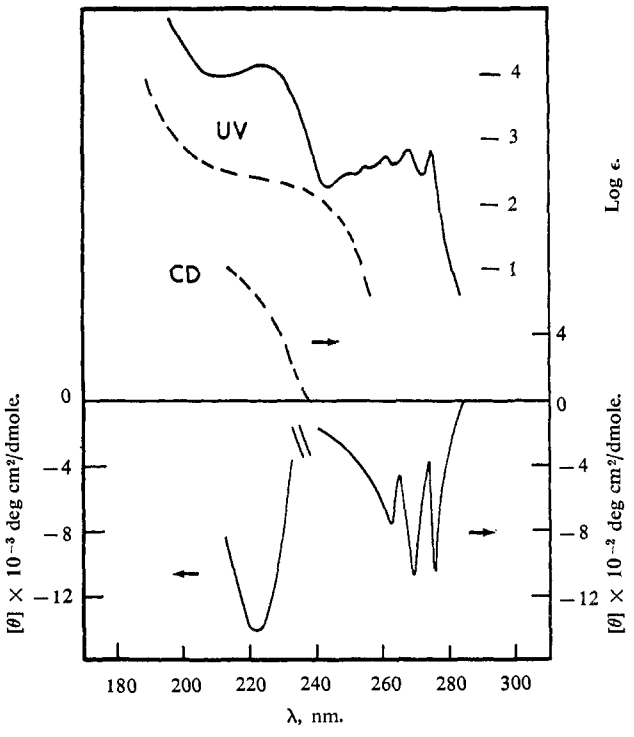

Figure 2. Ultraviolet and CD spectra of (−)-(1*R*,2*R*)-*trans*-1-methyl-2-phenylcyclopropane, (−)-**2** (solid curves), and (−)-(1*R*,2*R*)-*trans*-2-methylcyclopropanecarboxylic acid, (−)-**3** (dashed curves), in methanol solution. See ref 9 for explanation of the ordinate scales.

curve which is shifted in position from either of the component bands.[11]

Accordingly, the isotropic absorption and CD spectra of (−)-**2** were of interest since the carboxyl chromophore has been replaced by a methyl group. In this molecule only the phenyl ring has absorption bands above 210 nm. This point was confirmed by the preparation of *trans*-1-cyclohexyl-2-methylcyclopropane[12] from (−)-**2**. The ultraviolet spectrum of this molecule exhibited only end absorption down to 210 nm. The data for (−)-**2** in methanol solution are presented in Figure 2. It is seen that the 222-nm Cotton effect found in the CD spectrum of (−)-**1** is also present in (−)-**2**. The negative sign of this Cotton effect is characteristic of a phenyl ring attached to a carbon of the *R* configuration of a disubstituted cyclopropane derivative.

Assignment of the 222-nm peak in the isotropic absorption spectrum of (−)-**2** to the ^1L_a transition of the phenyl ring is substantiated by the absence of a corresponding peak in the spectrum of the cyclopropanecarboxylic acid (−)-**3** (Figure 2). Hence, in the CD spectrum of (−)-**2**, the negative Cotton effect at 222 nm is assigned to the optically active ^1L_a transition of the aromatic ring.

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The Isolation, Structural Elucidation, and Synthesis of Solapalmitine and Solapalmitenine, Two Novel Alkaloid Tumor Inhibitors from *Solanum tripartitum*[1,2]

Sir:

In a search for tumor inhibitors from plant sources, alcoholic extracts of *Solanum tripartitum* Dunal[3] showed significant inhibitory activity *in vitro* against cells derived from human carcinoma of the nasopharynx (KB).[4] We report herein the isolation, structural elucidation, and synthesis of *solapalmitine* and *solapalmitenine*, two novel tumor-inhibitory alkaloids from *S. tripartitum*.

Fractionation of the ethanol extract, guided by assay against KB, revealed that the active principles were concentrated, successively, in the aqueous layer of a chloroform–water partition and in the 1-butanol extract from the basified aqueous solution. Further fractionation involving dilute hydrochloric acid–dichloromethane partition, liberation from the acid solution with ammonium hydroxide, extraction, and chromatography on alumina yielded *solapartine*,[5] an apparently homogeneous liquid alkaloid, λ_{max}[6] 6.01 (amide CO), 6.15 and 10.20 μ (–CH=CH–); nmr τ 3.05 (sextet, J = 15 and 7 cps, NCOCH=C*H*CH$_2$–), 3.82 (doublet, J = 15 cps, NCOC*H*=CHCH$_2$–), 4.63 (multiplet, vinyl H), 6.62 (C*H*$_2$NCOR), 7.78 (NC*H*$_3$), 8.73 (C*H*$_2$), and 9.12 (CC*H*$_3$). The mass spectrum[7] of solapartine exhibited peaks at *m/e* 451 ($C_{28}H_{57}N_3O$, by high-resolution mass spectrometry[7]) and 453 ($C_{28}H_{59}N_3O$), and several small peaks at *m/e* 473, 475, 477, 479, and 481. Other prominent ions occurred at *m/e* 438, 436, 395, 393, 100, 98, 84, and 58 [(CH$_2$)$_2$-

(1) Tumor Inhibitors. XXVIII. Part XXVII: S. M. Kupchan, R. J. Hemingway, and J. C. Hemingway, *Tetrahedron Letters*, in press. High Resolution Mass Spectrometry in Molecular Structure Studies. XV. Part XIV: A. L. Burlingame, D. H. Smith, and R. W. Olsen, *Anal. Chem.*, in press.

(2) Supported by grants from the National Cancer Institute (CA-04500), the American Cancer Society (T-275), and the National Aeronautics and Space Administration (NsG 101), and a contract with the Cancer Chemotherapy National Service Center (CCNSC), National Cancer Institute, National Institutes of Health (PH-43-64-551).

(3) Whole plants were collected in Cochabamba, Bolivia, in April 1964. The authors acknowledge with thanks receipt of the dried plant material from Dr. Alejandro Asbun Lama. Voucher specimens are deposited in the University of Wisconsin Herbarium.

(4) Cytotoxicity and *in vivo* inhibitory activity were assayed under the auspices of the Cancer Chemotherapy National Service Center, by the procedures described in *Cancer Chemotherapy Rept.*, **25**, 1 (1952).

(5) Solapartine showed significant cytotoxicity (ED_{50}) against KB (human carcinoma of the nasopharynx) cell culture at 0.21 μg/ml. Solapartine, solapalmitine, and solapalmitenine showed significant inhibitory activity against Walker carcinosarcoma 256 in rats at 10 mg/kg.

(6) Infrared spectra were determined as thin films; nmr spectra were determined on solutions in deuteriochloroform.

(7) Both conventional and high-resolution mass spectra were determined on a CEC 21-110 mass spectrograph. Complete high-resolution mass spectra were recorded on a photoplate at a resolution of 25,000.

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