The first of these bands, at about 1.64 microns, apparently is due to the first overtone of the C–H stretching fundamental at 3.23 microns, while the second band, at about 2.24 microns, is probably a combination band. At the concentration and cell thickness used, the 1.64 micron band appears as a sharp band of weak intensity. The band at about 2.24 microns also appears sharp, but is in the neighborhood of from four to six times as intense as is the 1.64 micron absorption. Table I indicates the relative constancy of position of the absorption bands, and the range of compounds examined.

TABLE I

CHARACTERISTIC ABSORPTIONS IN THE NEAR-INFRARED FOR THE CYCLOPROPYL RING

Cyclopropane derivative	First overtone, μ	Combination, μ
α-Cyclopropylbenzhydrol	1.65	2.26
Cyclopropylethynylmethylcarbinol	1.64	2.24
Cyclopropylphenyl ketone	1.64	2.22
Ethyl 2-methylcyclopropanecarboxylate	1.64	2.27
γ-Morpholinopropyl 1-phenylcyclopropanecarboxylate	1.63	2.22
Cyclopropylethynylphenylcarbinol	1.64	2.23
Cyclopropylethylmethylcarbinol	1.64	2.23
Ethnylmethyl-(1-methylcyclopropyl)-carbinol	1.64	2.23
1-cyclopropyl-1-methylpent-2-yne-4-ene-ol	1.64	2.22

While the band at 2.24 microns lies quite close to the combination bands of saturated CH_2 and CH_3, the band at 1.64 microns is well separated from the first overtone of saturated aliphatics. The only other functional group we have found to give rise to absorptions at these wave lengths is terminal methylene ($=CH_2$). Fortunately, when doubt exists, the terminal methylene easily may be confirmed by its absorptions in the 3 to 15 micron region.

In view of the well known ambiguities encountered in detecting cyclopropyl derivatives through absorption in the 3.2–3.3 and the 9.7–10.0 micron regions,[1-4] especially in the presence of aromatic rings and most types of aliphatic unsaturation, we feel that by using the near-infrared correlations a more certain confirmation of the cyclopropyl group can be made.

(1) C. F. H. Allen, T. J. Davis, W. J. Humphlett and D. W. Stewart, *J. Org. Chem.*, **22**, 1291 (1957).
(2) A. R. H. Cole, *J. Chem. Soc.*, 3807 (1954).
(3) F. J. Piehl and W. G. Brown, THIS JOURNAL, **75**, 5023 (1953).
(4) S. E. Wiberley and S. C. Bunce, *Anal. Chem.*, **24**, 623 (1952).

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NEW FACTORS IN PYRIMIDINE BIOSYNTHESIS

Sir:

It has been found that the radioactive specific pyrimidine precursors, orotic and ureidosuccinic acids, are incorporated into the acid insoluble fraction of some mammalian tissues to a greater extent than can be accounted for by the uridylic, cytidylic, and thymidylic acids present. The data below give some of the characteristics and biosynthetic data on a substance, probably a pyrimidine nucleotide, thought to be formed from these precursors. This substance also has been shown to be present in *fresh* rat tissue as a normal constituent in the absence of added ureidosuccinic or orotic acids.

Following incubation of three to four grams of rat liver with the precursor by methods previously described,[1] protein precipitation, with cold trichloroacetic acid, and lipid extraction were carried out. The residue was dissolved in 1 *N* KOH as in the Schmidt–Thannhauser procedure.[2] The DNA and protein were precipitated by acidification to *p*H 6 with HCl and addition of concentrated trichloroacetic acid to a final concentration of five per cent. The supernatant was brought to a volume of approximately 0.5 ml., heated for one hour at 100° and submitted to paper chromatography in a tertiary butyl–HCl solvent.[3] In confirmatory experiments, the silver salts of the pyrimidine nucleotides

SPECIFIC ACTIVITIES OF PYRIMIDINE NUCLEOTIDES FROM RAT LIVER SLICES AFTER INCUBATION WITH EITHER 1 MG. OF C-14-OROTIC ACID CONTAINING 2,720,000 COUNTS OR 2 MG. OF C-14-UREIDO-SUCCINIC ACID CONTAINING 2,534,000 COUNTS

	Relative amounts, μmoles	Ultraviolet max, mμ, at *p*H 2	Ratio 278 mμ 262 mμ at *p*H 2	Counts/min./μmole[c]
Expt. 1, C-14-Orotic acid				
Uridylic acid	4.2	262	0.45	5900
Substance X[a]	1.0	262	0.53	135000
Cytidylic acid	5.9	278	1.59	1070
Expt. 2, C-14-Orotic acid (lowered oxygen tension)[d]				
Uridylic acid	4.1	262	0.46	412
Substance X'[b]	0.32	266	0.80	40000
Cytidylic acid	5.7	278	1.58	44
Expt. 3, C-14-Ureidosuccinic acid				
Uridylic acid	5.0	262	0.47	16600
Substance X	0.89	262	0.54	179000
Cytidylic acid	5.9	278	1.58	566
Expt. 4, C-14-Ureidosuccinic acid (lowered oxygen tension)[d]				
Uridylic acid	4.7	262	0.46	752
Substance X'	0.32	266	0.78	29600
Cytidylic acid	6.3	278	1.60	63

[a] Quantified spectrophotometrically. A molecular extinction of 8400, based on phosphorus analyses, was used for Substance X. [b] Values obtained by assuming a molecular extinction of 8400 for purposes of comparison with Substance X. (If one assumes the amount of X' to be equivalent to X and that the flattened spectrophotometric curve indicates a lower molecular extinction, then it can be calculated that the ratios of specific activity of X' to uridylic acid in Experiments 2 and 4 more nearly approximate those of X to uridylic acid in Experiments 1 and 3.) [c] In all instances uridylic and cytidylic acids were counted as the nucleotide, then hydrolyzed with formic acid and counted as the free base. The results were in good agreement except for a small drop in the specific activity of the cytosine, compared to the cytidylic acid, in the ureidosuccinate experiments. The counts of the free base are those recorded. [d] In experiments 2 and 4 alternate slices of the same batch of rat livers as used in 1 and 3 were treated in the same manner except they were incubated under a lowered oxygen tension.

(1) L. L. Weed and D. W. Wilson, *J. Biol. Chem.*, **189**, 435 (1951).
(2) G. Schmidt and S. J. Tannhauser, *ibid.*, **161**, 83 (1945).
(3) J. D. Smith and R. Markham, *Biochem. J.*, **46**, 509 (1950).

were first isolated before chromatography and identical results were obtained. The faint band (R_f 0.72) seen just below the uridylic acid (R_f 0.84) on the ascending chromatogram was eluted and submitted to paper electrophoresis,[4,5] which resolved it into two bands, 8 cm. and 4 cm. from the starting point respectively. The 8-cm. band contained most of the radioactivity and is identified as Substance X in the table. In those experiments in which liver slices were incubated under lowered oxygen tension (Exp. 2 and 4 in the table) the material in the 8-cm. band on electrophoresis had modified spectrophotometric characteristics and is therefore called X′. The 4-cm. band will be discussed separately in another communication. The results are shown in the table.

These experiments have been confirmed in both normal rat liver and sarcoma-37. If the nucleic acid is extracted from rat liver by the use of hot ten per cent. sodium chloride and subsequently carried through the same hydrolysis and chromatographic procedures, then less than 15% as much of the unknown ultraviolet absorbing material is obtained relative to the yield of uridylic acid. Since DNA is also present in the sodium chloride extracted nucleic acid, diphosphate forms of DNA pyrimidine nucleotides occur on the original chromatogram in the region occupied by X. These were separated and quantified by Dowex-1 column studies.[6]

Substance X, obtained by the steps described above, was absorbed on a Dowex-1 resin column and was eluted in a single peak with 0.002 *N* HCl without significant alteration in the molecular extinction based on phosphorus analysis, or in the R_f values in the tertiary butyl alcohol–HCl solvent. Spectrophotometric curves on the material from the resin column were obtained, and at *p*H 2 and *p*H 12 the maximum absorptions were 262 and 265 mμ, the minimum absorptions were at 232 and 248 mμ, and the 280/260 mμ ratios were 0.44 and 0.72, respectively. These findings suggest that the substance is not similar to the nucleotide recently described by Davis and Allen.[7] Whether materials X and X′ are or are not orotidylic and dihydroorotidylic acids, respectively, cannot be stated for certainty from the present data.

It should be noted in the table that lowered oxygen tension also affects the uridylic/cytidylic acid specific activity ratios.[8]

(4) R. Markham, and J. D. Smith, *J. Biochem.*, **52**, 552 (1952).
(5) L. L. Weed, and T. A. Courtenay, *J. Biol. Chem.*, **206**, 735 (1954).
(6) L. L. Weed and D. W. Wilson, *ibid.*, **202**, 745 (1953).
(7) F. F. Davis and F. W. Allen, *ibid.*, **227**, 907 (1957).
(8) L. L. Weed, *Canc. Res.*, **11**, 470 (1951).

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BOOK REVIEWS

Structure Reports for 1940–1941. Volume 8. General Editor: A. J. C. WILSON, University of Wales, Cardiff, Great Britain. Section Editors: N. C. BAENZIGER (Metals), University of Iowa; J. M. BIJVOET (Inorganic Compounds), University of Utrecht, Holland; and J. MONTEATH ROBERTSON (Organic Compounds), University of Glasgow, Great Britain. N. V. A. Oosthoek's Uitgevers Mij., Domstraat 1–3, Utrecht, Holland. 1956. viii + 384 pp. 16.5 × 25 cm. Price, $21.50.

With the appearance of this volume, the gap has been filled between the last issue of Strukturberichte (Vol. 7 for 1939 was prepared by K. Herrmann under the editorship of M. V. Laue, for the *Z. Krist.*) and the first issue of "Structure Reports" (Vol. 11, for 1947–1948). A complete summary of practically all the literature on crystal and molecular structures as derived from diffraction studies published through 1950 has thus become available. The price of the present volume had been set at a figure which should recover the cost of production, in contrast to volumes 10–13 which were distributed at a substantially lower price, made possible by subsidies from UNESCO and other organizations.

The editors undertook no extensive search of the literature for 1939 and for earlier years, but omissions noticed incidentally in the later issues of the Strukturberichte have been remedied in this volume. The arrangement of material is similar to that used for the volumes which have already appeared. Preceding the introduction by the editor, there appear a list of the symbols used, a statement of the meaning of the specified limits of error, and a table for the transliteration of the Russian alphabet. The main body of the text is divided into three sections: metals (p. 3–115), inorganic compounds (p. 119–259), and organic compounds (p. 263–346). There follow six pages of abstracts of miscellaneous topics; the book is concluded by a list of journal abbreviations, a subject index, a formula index, an index of carbon compounds, an author index, and a page of additional corrections covering volumes 8 through 12. As a matter of policy, a certain amount of selectivity has been followed in the preparation of these volumes, in that information such as statements on texture, power data and electron diffraction data has been reported only for substances of structural interest. For an appreciable number of cases, interatomic distances have been computed by the abstractor. The typography is of the same high quality which has characterized the previous issues.

The General Editor, A. J. C. Wilson, the Section Editors, and the committee on "Structure Reports" should be commended for the fine job they have done in assembling the large amount of structural data which appeared during the interval 1939–1950. The value of these compilations to research workers and students has been stressed by reviewers of the previous volumes. We can only join the acclaim and express the hope that publication of "Structure Reports" will be continued on a regular basis.

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