

reduction in 50% aqueous acetic acid with zinc for forty-five minutes was sufficient for reductive removal of the trimethylammonium group from both methiodides. The two resulting desdimethylamino products were identical. Desdimethylaminotetracycline: $[\alpha]_{25}^{D} -250^{\circ}$ (0.5% in methyl cellosolve); m.p. 195° (dec.); *Anal.* Calcd. for $C_{20}H_{19}NO_8$: C, 59.75; H, 4.77; N, 3.49. Found: C, 59.80; H, 4.72; N, 3.30. "Desdimethylaminoquatrimycin": $[\alpha]_{25}^{D} -251^{\circ}$ (0.5% in methyl cellosolve); m.p., 195° (dec.); *Anal.* Found: C, 59.40; H, 4.88; N, 3.42. Mixed melting point showed no depression.⁶

This represents necessary and sufficient proof that the quatrimycins are the 4-epitetracyclines.

J. R. D. McCORMICK
SIDNEY M. FOX
CHEMICAL PROCESS IMPROVEMENT DEPT. LELAND L. SMITH
LEDERLE LABORATORIES DIVISION BARBARA A. BITLER
AMERICAN CYANAMID COMPANY JULES REICHENTHAL
PEARL RIVER, NEW YORK VICTOR E. ORIGONI
WALTER H. MULLER
ROBERT WINTERBOTTOM
ALBERT P. DOERSCHUK

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THE BIOSYNTHESIS OF α, ϵ -DIAMINOPIMELIC ACID.
I. ISOLATION OF AN INTERMEDIATE, ACTIVE
FOR A DIAMINOPIMELIC ACID-REQUIRING *E. COLI*
MUTANT

Sir:

It has been well established¹ that α, ϵ -diaminopimelic (DAP) acid is found in many Gram-negative and some Gram-positive organisms. The biosynthetic mechanism of DAP synthesis is at

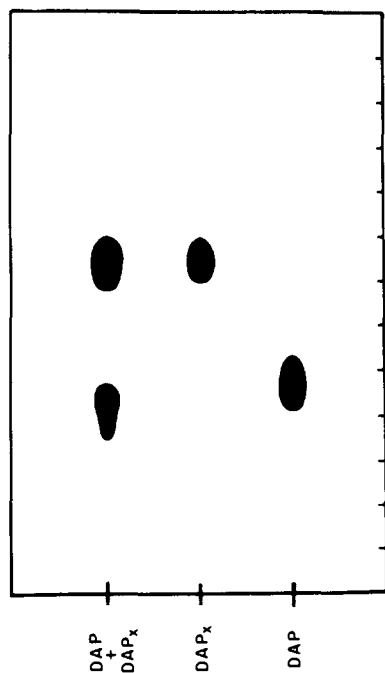
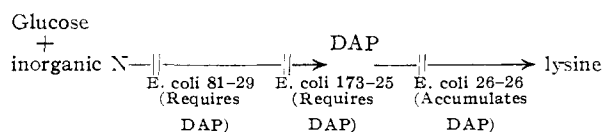


Fig. 1.—The chromatographic behavior of a material having growth-supporting activity for a DAP-requiring *E. coli* mutant: solvent, methanol (80), water (20), pyridine (4); temp. 25; descending system, Whatman No. 1 paper, bioautographic plate, using *E. coli* 81-29.

(1) E. Work and D. L. Dewey, *J. Gen. Microbiol.*, **9**, 394 (1953).

present unknown and it is the purpose of this communication to report the isolation of a biologically active compound apparently formed as an intermediate in the biosynthesis of DAP.

The biosynthesis of DAP can be accomplished by *E. coli*, using glucose as a sole source of carbon. Using the mutant² system illustrated below, it has been possible to isolate a preparation, active for a DAP-requiring mutant, *E. coli* S1-29.



This biologically active material was designated as DAP_x for convenience.

DAP_x is extracted from lyophilized *E. coli* 26-26 supernates at pH 3-5 with diethyl ether, methylene chloride and *n*-butanol. The solvents are removed *in vacuo* and the solids dissolved in water and freeze-dried to yield a yellowish-brown product. Chromatography of DAP_x in a methanol-water-pyridine system and subsequent analysis on a bioautographic plate (Fig. 1) demonstrated that the material was different from DAP.

The material was found to be ninhydrin-negative, heat stable and acidic in character. Counter-current distribution using *n*-butanol and water at pH 3 yielded a highly active fraction which was obtained in a pure state by crystallization from *n*-butanol. The material was identified as succinic acid by its infrared spectrum and by comparison of the free acid (m.p. and mixed m.p. 187.5-188.5°) and its *p*-bromophenacyl ester (m.p. and mixed m.p. with 214-215°) authentic specimens.

Subsequent studies with *E. coli* 26-26 have shown that aspartic acid, succinic acid, pyruvic acid, triphosphopyridine nucleotide (TPN) and adenosine triphosphate (ATP) stimulate the synthesis of DAP by cell-free extracts. The stimulation of DAP synthesis by the compounds described above extend and confirm the report of Gilvarg³ which appeared at the time this manuscript was in preparation.

Further studies on the biosynthetic mechanism of DAP synthesis are in progress and will be a subject of future publication.

(2) The three *E. coli* mutants were kindly obtained from Dr. B. Davis, New York University.

(3) C. Gilvarg, *Fed. Proc.*, 261 (1956).

RESEARCH LABORATORIES
THE UPJOHN COMPANY
KALAMAZOO, MICH.

LIONEL E. RHULAND
BRIAN BANNISTER

RECEIVED MAY 21, 1956

A NEW TWO STRANDED HELICAL STRUCTURE:
POLYADENYLIC ACID AND POLYURIDYLIC ACID
Sir:

While studying the X-ray diffraction patterns of synthetic nucleotide polymers, we mixed together the sodium salts of polyadenylic acid and polyuridylic acid.¹ There resulted a very rapid

(1) M. Grunberg-Manago, P. J. Ortiz and S. Ochoa, *Science*, **122**, 907 (1955).