verts the compound to the known trimethylplatinum iodide.

These two organoplatinum compounds are interesting because they demonstrate for the first time that true organoplatinum compounds not having acid radicals can be prepared. A detailed account of these and other organoplatinum compounds will be published shortly.

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RECEIVED OCTOBER 31, 1938

THE IDENTIFICATION OF METHYLCHAVICOL IN AMERICAN GUM SPIRITS OF TURPENTINE

Sir:

Recent investigations have shown that gum spirits of turpentine of slash and longleaf pine contain about 95% of pinenes [Dupont, *Ann. chim.*, [10] **1**, 184 (1924); Aschan, "Naftenföreningar, Terpener och Kamferarter," Helsingfors, 289 (1926); Palkin, Technical Bulletin 596, U. S. Department of Agriculture (1932)]. We have been able to obtain physical and chemical evidence, including the fact that homoanisic acid is obtained on oxidation, that the fractions boiling above those of the pinenes contain considerable amounts of methylchavicol (4-methoxyallylbenzene).

This was shown by the isolation of methylchavicol from turpentine by the method described by Balbiano [*Ber.*, **42**, 1504 (1909)], for the separation of methylchavicol from anethole. Seventy-five grams of a fraction, b. p. 88–95° at 10 mm., obtained by fractionation of steam-distilled residues of spirits of turpentine was dissolved in 400 cc. of ether and shaken for one hour with a solution of 81 g. of mercuric acetate dissolved in 350 cc. of water. After separating the ether, the aqueous solution was heated for ten hours at 70–80° with 70 g. of sodium hydroxide and 80 g. of granulated zinc. The mixture was then distilled with steam, the distillate extracted with ether and the ether solution dried and distilled, leaving 8 g. of methylchavicol, the main fraction of which boiled at 213–215°; d^{25}_{25} 0.9600; n^{22}_D 1.51372. Physical constants recorded in the literature are: b. p. 214–215° [Klages, *Ber.*, **32**, 1439 (1899); d^{21} 0.9645; n_D 1.5236; (Beilstein, "Handbuch der organischen Chemie," fourth edition, **6**, 571 (1923)]. Ten grams of this product was oxidized at room temperature with 630 cc. of 4% potassium permanganate solution. After removal of manganese dioxide, the filtrate was evaporated to about one-third of its original volume and acidified with hydrochloric acid. The precipitated anisic acid was recrystallized from water and melted at 184–185° (corr.); yield, 2.5 g. Calcd. for $C_8H_8O_3$: C, 63.18; H, 5.30. Found: C, 63.32; H, 5.46. The acid did not lower the melting point in the mixed melting point test with an authentic sample of this material.

The aqueous filtrate from which the anisic acid had been removed was evaporated to a small volume, extracted with ether and dried. The ether was distilled and about 0.3 g. of a substance, apparently homoanisic acid, was obtained. It was recrystallized from water and melted at 85.5–86.5°. Homoanisic acid melts at 85–86° [Pschorr, Wolfes and Buckow, *Ber.*, **33**, 172 (1900)]. Calcd. for $C_9H_{10}O_3$: C, 65.04; H, 6.07. Found: C, 65.30; H, 6.54.

We assume that the difference in odor between highly purified turpentine and American gum spirits of turpentine can be partly attributed to the presence of phenol ethers.

G. & A. LABORATORIES, INC.
SAVANNAH, GEORGIA
TORSTEN HASSELSTROM
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RECEIVED OCTOBER 28, 1938

PANTOTHENIC ACID AS A GROWTH FACTOR FOR THE DIPHTHERIA BACILLUS

Sir:

It has been shown in experiments already presented elsewhere that β-alanine and nicotinic acid are essential for the growth of certain strains of the diphtheria bacillus [Mueller, *Proc. Am. Exptl. Biol. Med.*, **36**, 706 (1937)]. β-Alanine has long been known to be a constituent of meat extract both in the free form and also combined with histidine in the compound carnosine, in which form it has also been shown to be available to the diphtheria bacillus [Mueller, *J. Biol. Chem.*, **123**, 421 (1938)]. In a personal communication, we have recently learned from Dr. R. J. Williams that pantothenic acid [Williams, *et. al.*, THIS JOURNAL, **55**, 2912 (1933); **60**, 2719 (1938)] also yields β-alanine upon hydrolysis. Dr. Williams suggests, further, that β-alanine may be effective in producing growth with *C. Diphtheriae* only insofar as it serves as a building stone for the production of pantothenic acid, which may be the material actually required by the organism, and he has supplied us with specimens of pantothenic acid and calcium pantothenate in varying degrees of purity. With this material we have been able to test out this theory and to show that it well may be correct.

Using a control medium containing the products of complete acid hydrolysis of casein, lactic, pimelic and nicotinic acids and inorganic salts, but completely deficient in β-alanine, a series of media has been prepared in which increasing quantities of β-alanine were added to one set, pantothenic acid or calcium pantothenate to a second and the latter substance hydrolyzed by autoclaving with normal hydrochloric acid for thirty minutes at 15 lb. (1 atm.) to a third. The various media were autoclaved (*p*H 7.6) for ten minutes at 10 lb. (0.67 atm.) pressure. After inoculation with the strain of the diphtheria bacillus (Allen), and incubation for three days at 35°, the resulting bacterial growth was centrifuged down, washed and the bacterial nitrogen determined by a method already described, as a measure of bacterial growth [Mueller, *J. Bact.*, **29,** 383 (1935)]. The table shows the results obtained: A = β-alanine; B = Ca pantothenate (about 50%) stated to yield 16% β-alanine on hydrolysis; C = solution B after acid hydrolysis.

	γ added/10 cc. medium			Mg bacterial N/10 cc. medium		
	A	B	C	A	B	C
1 Control +	..	0.0	..	..	0.13	..
2 Control +	..	.31	..	..	.41	..
3 Control +	..	.62	..	..	.60	..
4 Control +	..	1.5	1.5	..	1.47	0.32
5 Control +	..	3.1	3.1	..	2.78	.16
6 Control +	1	6.2	6.2	0.39	3.67	.29
7 Control +	2.5	15.5	15.5	.24	4.70	2.05
8 Control +	5	31	31	6.12	5.35	5.76
9 Control +	10	62	62	6.78	6.60	lost[a]
10 Control +	20	125	..	7.30	7.06	..

[a] Heavy growth.

This and other similar experiments uniformly show a smooth, gradual increase in growth with the addition of pantothenic acid, whereas with β-alanine there is no definite increase over controls until a concentration of from about 2.5 γ per 10 cc. is used. At this point, initiation of growth is slow and irregular, possibly dependent on the size of the inoculum, (platinum loop of pellicle). At levels of 5, 10 and 20 γ concentration of β-alanine or its equivalent of panthothenic acid, growth is heavy and the amounts produced by the two materials are very nearly the same. Hydrolysis of pantothenic acid yields a solution with the properties of β-alanine, *i. e.*, no effect until the concentration of the latter in the hydrolytic products reaches 2.5 γ/10 cc. medium, whereas doubling this concentration regularly leads to heavy growth.

These facts tend to support the view that β-alanine must first be built up into some more complex material before it may be directly utilized by *C. Diphtheriae*, whereas with pantothenic acid no such preliminary synthesis is required.

It is interesting and significant that Snell, Brown and Peterson [THIS JOURNAL, **60,** 2825 (1938)] have shown recently that both pantothenic acid and nicotinic acid are apparently essential factors for growth of certain strains of the lactic acid bacteria. These organisms, unlike the diphtheria bacillus, seem to be unable to effect the synthesis of pantothenic acid from β-alanine, requiring the presence of the more complex material for satisfactory growth.

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RECEIVED NOVEMBER 23, 1938

PRESSURE-AREA RELATIONS FOR MONOMOLECULAR FILMS OF TRI-*p*-CRESYL PHOSPHATE AND RELATED COMPOUNDS

Sir:

Interesting differences in surface activity have been observed in a study of phosphorus-organic compounds closely related in structure. Monomolecular film properties of the three isomers of tricresyl phosphate (ortho, meta and para) are practically identical but quite unlike those of either tri-*p*-cresyl phosphite or tri-*p*-cresyl thiophosphate.

Pressure-area relations have been studied on a modified Cenco film-balance apparatus, using general techniques similar to those described by N. K. Adam[1] and Harkins, Ries and Carman.[2,3] The volatile solvent used for the Eastman compounds was twice-distilled benzene. Films were spread on distilled water.

Tri-*p*-cresyl phosphate forms well-behaved, compressible films, whereas the corresponding phosphite and thiophosphate show extremely poor film-forming properties. Films of the phosphite and thiophosphate require compression far beyond the minimum film area for monomolecular

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[1] N. K. Adam, "The Physics and Chemistry of Surfaces," Clarendon Press, Oxford, 1938.

[2] Harkins, Ries and Carman, THIS JOURNAL, **57,** 2224 (1935).

[3] Harkins, Carman and Ries, *J. Chem. Phys.*, **3,** 692 (1935).