In an octahedral complex of the composition $Ma_4B_2^{+n}$, the *trans* isomer has no net dipole moment while the *cis* isomer does. It seems reasonable for the polar ion to be more strongly held in the resin phase than the non-polar ion of the same composition and charge. Since the nitro group is one of the most polar groups, the system studied here may prove to be the one in which the separation of isomers by this method is most easily accomplished.

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THE ISOMERIZATION OF CYCLOPROPANE—A QUASI-UNIMOLECULAR REACTION

Sir:

In 1942 Pease[1] concluded that with the possible exception of the thermal isomerization of cyclopropane investigated by Chambers and Kistiakowsky,[2] there was no case of quasi-unimolecular reaction known, which provided unequivocal confirmation of the theory of unimolecular reactions proposed by Lindemann, Hinshelwood, Rice, Ramsperger, Kassel[3] and others. Later Corner and Pease[4] reinvestigated the isomerization of cyclopropane to propylene and concluded that as the addition of unreactive gases had little effect, the fall-off of the apparent first-order rate constant was more reasonably explained by a complex reaction mechanism than by an energy transfer process.

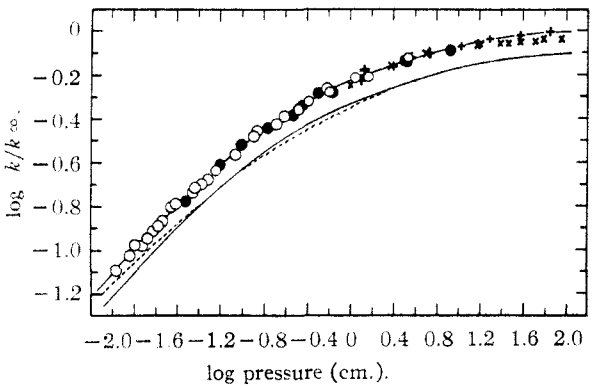

Fig. 1.

There now appear to be two well-established cases of the falling-off of unimolecular rate constants in the decomposition of nitrogen pentoxide[5] and nitrous oxide.[6] We have reinvestigated the isomerization of cyclopropane at 492° in a 2-l. Pyrex reaction vessel extending the measurements below the 10 mm. pressure limit of previous workers down to 0.1 mm. The reaction was followed by the analysis of the cyclopropane–propylene mixture for olefin content on a Blacet–Leighton[7] apparatus using a mercuric acetate bead.[8] There is good evidence that no side-reactions occurred for in an aged reaction vessel no condensation took place and no products non-condensable in liquid nitrogen were formed. Our results are shown together with those of other workers in Fig. 1. The theoretical curve, following Chambers and Kistiakowsky,[2] is calculated from Kassel's[3] equation using a collision diameter of 3.9 Å., 13 oscillators and a value of k_∞, the rate at infinite pressure, given by

$$\log k_\infty = 15.17 - \frac{65{,}000}{2.3RT}$$

Furthermore we have investigated the effect of added hydrogen on the rate constant at low cyclopropane pressures. The hydrogen causes a marked increase in the rate constant and is about one-fifth as efficient as cyclopropane or propylene in restoring the rate constant. The comparatively low efficiency of hydrogen is evidently the reason why Corner and Pease could find no effect which in their case would have been 4%, for this is the order of their experimental error. Accordingly it seems that this reaction is a clear cut case of the falling-off of the rate of a unimolecular gas reaction with pressure.

We are now investigating the effect of the addition of a number of non-reacting gases to the system and hope to publish the results in detail when a full survey has been completed.

(1) R. N. Pease, "Equilibrium and Kinetics of Gas Reactions," Princeton, N. J., 1942, p. 147.
(2) T. S. Chambers and G. B. Kistiakowsky, THIS JOURNAL, **56**, 399 (1934).
(3) L. S. Kassel, "Kinetics of Homogeneous Gas Reactions," Chemical Catalog Co., New York, N. Y., 1932, p. 93.
(4) E. S. Corner and R. N. Pease, THIS JOURNAL, **67**, 2067 (1945).
(5) H. S. Johnston and R. L. Perrine, *ibid.*, **73**, 4782 (1951).
(6) H. S. Johnston, *J. Chem. Phys.*, **19**, 663 (1951).
(7) F. E. Blacet and P. A. Leighton, *Ind. Eng. Chem., Anal. Ed.*, **3**, 266 (1931).
(8) R. Pyke, A. Cahn and D. J. LeRoy, *Anal. Chem.*, **19**, 65 (1947).

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EFFECT OF PURINES ON A SUCCINYLSULFATHIAZOLE (SST)-INDUCED DEFICIENCY IN MICE

Sir:

The addition of succinylsulfathiazole (SST) to a purified diet having a low fat content was reported to cause a retardation of growth in weanling mice.[1] This effect on growth was prevented if such materials as fat, a defatted cottonseed meal, or rolled oats were added to the basal diet. Whereas whole liver was found to be without effect it has since been found that a water extracted liver residue is also effective. It was tentatively concluded in this earlier report that fat *per se* is an essential nutrient for animal growth. It was further suggested that in the absence of adequate quantities of dietary fat a factor, or factors, synthesized by SST-susceptible intestinal microorganisms is essential for fat synthesis by the animal. This factor, or factors, was postulated to be present in those fat-free natural materials that are capable of preventing the SST-induced growth retardation.

(1) D. K. Bosshardt, W. J. Paul, R. H. Barnes and J. W. Huff, *Proc. Soc. Exptl. Biol. Med.*, **75**, 722 (1950).

Studies were initiated in these laboratories to isolate the active ingredient from cottonseed. During the course of this investigation a compound was obtained in crystalline form which was found to be partially effective in preventing the SST-induced growth retardation in mice. This compound was identified as the purine, guanine.

TABLE I

EFFECT OF PURINES AND PURINE RIBOSIDES ON A SST-INDUCED GROWTH RETARDATION IN MICE[a]

Diet	Av. 12-day wt. gain, g.
Control	9.1
2% SST	4.6
2% SST + 5% Cottonseed meal[b]	8.6
2% SST + 15% Cottonseed meal	10.8
2% SST + 0.02% Adenine	8.3
2% SST + 0.08% Adenine	8.8
2% SST + 0.02% Guanine	7.8
2% SST + 0.08% Guanine	7.4
2% SST + 0.02% Xanthine	8.1
2% SST + 0.08% Xanthine	8.9
2% SST + 0.02% Hypoxanthine	9.5
2% SST + 0.08% Hypoxanthine	8.2
2% SST + Adenosine equiv. to 0.02% adenine	7.8
2% SST + Adenosine equiv. to 0.08% adenine	9.0
2% SST + Guanosine equiv. to 0.2% guanine	7.6
2% SST + Guanosine equiv. to 0.08% guanine	8.1
2% SST + Inosine equiv. to 0.02% hypoxanthine	8.2
2% SST + 1% Yeast Ribonucleic acid (GBI)	9.0

[a] Eight male mice per group. [b] Proflo, Traders Oil Mill Co., Fort Worth, Texas.

The purines adenine, guanine, xanthine and hypoxanthine as well as the ribosides adenosine, guanosine and inosine were tested with growing mice using the SST containing low fat basal diet. The results obtained are shown in Table I. All of the purines and purine ribosides that were studied as well as yeast ribonucleic acid were found to be able partially to replace cottonseed in preventing the SST-induced growth retardation.

On the basis of the data presented here purines may function to modify the action of succinylsulfathiazole thus permitting the intestinal microorganisms to synthesize an as yet unknown factor which possibly plays some role in fat metabolism. On the other hand purines or nucleic acids may represent essential accessory food factors required for fat metabolism in the mouse.

In other studies, to be reported later, it has been found that other stress agents such as thyroid active materials or atabrine administered orally, or injected thyroxine cause a retardation of growth in mice fed a low fat diet. In these cases it is also possible to prevent this growth retardation by the feeding of cottonseed meal, fat, or a water extracted liver residue. It is possible that the beneficial effects of extracted liver residue in overcoming the toxicity of thyroxine or atabrine in the rat that were reported by Ershoff[2-4] may be due to the nucleic acids or their degradation products present in the extracted liver residue.

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(2) B. H. Ershoff, *Arch. Bio.*, **15**, 365 (1947).
(3) B. H. Ershoff and H. B. McWilliams, *Science*, **108**, 632 (1948).
(4) B. H. Ershoff, *J. Nut.*, **35**, 269 (1948).

HYPOTENSIVE ALKALOIDS OF VERATRUM FIMBRIATUM GRAY

Sir:

Two new hypotensively active ester alkaloids, germanitrine and germinitrine, have been isolated from *Veratrum fimbriatum* Gray.

The extraction procedure employed was essentially the same as the one reported in our previous investigation of *Veratrum viride* Ait.[1] The crude amorphous fraction thus obtained was subjected to an eight plate countercurrent distribution using benzene–2*M* acetate buffer *p*H 5.5 as the solvent system with the lower phase moving. This yielded two main fractions, A (tubes 0–1) and B (tubes 2–5).

Fraction A was distributed on a 24-plate countercurrent machine with 0.5 *M* sodium acetate buffer *p*H 5.0—benzene–cyclohexane 40:60. Careful fractional crystallization of the material recovered from tubes 4–14 from acetone–water gave germanitrine, and germinitrine.

Germanitrine crystallized as heavy needles; m.p. 228–229°; $[\alpha]^{24}D$ −61 ± 2° (*C* 1.0 in pyr.); 0.0 ± 2° (*C* 1.15 in $CHCl_3$). Analytical data indicate the empirical formula $C_{39}H_{59}O_{11}N$; calcd. C, 65.25; H, 8.28; N, 1.95; eq. wt., 717.87; found: C, 65.30; H, 8.26; N, 1.99; eq. wt., 721; picrate, m.p. 240–241° (dec.), $C_{39}H_{59}O_{11}N\cdot HOC_6H_6(NO_2)_3$: C, 57.07; H, 6.60; found: C, 56.68; H, 6.52. Volatile acid determination, found: 2.66 equivalents of acid. Alkaline hydrolysis of germanitrine yielded germine, acetic acid, methylethylacetic acid and tiglic acid.[2]

On methanolysis germanitrine was converted to a di-ester, germanidine, by the loss of the labile acetyl group; m.p. 221–222°; $[\alpha]^{24}D$ −4.1 ± 2° (*C* 1.0 in pyr.); + 18.1 ± 2° (*C* 0.49 in $CHCl_3$). Analytical data indicate the empirical formula $C_{37}H_{57}O_{10}N$: (calcd. C, 65.75; H, 8.50; eq. wt., 675.84; found: C, 65.66; H, 8.61; eq. wt., 672). Volatile acid determination, found: 1.97 equivalents of acid.

Germinitrine crystallized as irregular prisms; m.p. 175–176°; $[\alpha]^{24}D$ −36.0 ± 2° (*C* 1.12 in pyr.); +7.8 ± 2° (*C* 1.35 in $CHCl_3$). Analytical data indicate the empirical formula $C_{39}H_{57}O_{11}N$; calcd. C, 65.43; H, 8.03; N, 1.96; eq. wt., 715.85; found: C, 65.35; H, 8.27; N, 1.61; eq. wt., 722; picrate, m.p. 238° (dec.), $C_{39}H_{57}O_{11}N\cdot HOC_6H_2(NO_2)_3$: C, 57.19; H, 6.40; found: C, 57.17; H, 6.66. Volatile acid determination, found: 2.32 equivalents of acid. Alkaline hydrolysis of germinitrine yielded germine, acetic acid, tiglic acid and angelic acid.[2]

Fraction B was distributed on a 24-plate counter-

(1) M. W. Klohs, R. Arons, M. D. Draper, F. Keller, S. Koster, W. Malesh and F. J. Petracek, THIS JOURNAL, **74**, in press (1952).
(2) The acids were identified by conversion to their *p*-phenylphenacyl esters and characterized after chromatographic separation.