ments in which we tested several hundred substances on several hundred thousand pig Ascaris *in vitro,* collected the parasites passed, as well as those found at autopsy, in many hundreds of dogs infested with Ascaris, and egg-counted over 3,000 human cases of ascariasis before and after treatment.

During the course of these experiments we checked as a matter of interest, but with no intent of publication, the effect of 121 substances on both earthworms and pig Ascaris, using the *in vitro* method described in our "Methods" paper. The earthworms were tested in distilled water at room temperature, while the Ascaris were kept at 35° in saline. Of these 121 chemicals chosen from *inorganic substances, hydrocarbons, halogenated hydrocarbons, alcohols, phenols, ethers, organic acids* and their *salts, organic sulfur compounds, terpenes, sesquiterpenes, alkaloids, enzymes, glucosides, plant products, dyes, substances liberating oxygen* or *iodine,* as well as a miscellaneous group, only 6 per cent. showed a fairly close correspondence of anthelmintic action on earthworms and pig Ascaris. In 58 per cent. the Ascaris were alive after twenty hours, while the earthworms had died in from two minutes to six hours. Sixty-seven per cent. killed earthworms in thirty minutes or less, while only 8 per cent. of these substances killed Ascaris in that time.

Conclusion

(1) The use of earthworms as a test object for evaluating the activity of anthelmintics to be used in human intestinal helminth infestation is irrational.

(2) A comparative study of the lethality of 121 widely diversified chemical substances on both earthworms and pig Ascaris shows no correlation of action.

(3) *In vitro* tests of human ascaricides on pig Ascaris, which is morphologically indistinguishable from human Ascaris, are of value.

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CATALYSIS OF FORMALDEHYDE TO REDUCING SUGARS BY ASCORBIC ACID

Kusin[1] has recently shown that compounds capable of forming en-diol groups in alkaline solution (glucose, fructose, benzoin, etc.) markedly catalyze the production of reducing sugars from formaldehyde in the presence of calcium hydroxide. According to Haworth's formula ascorbic acid contains the en-diol group and, if Kusin's theory is correct, might be expected to catalyze the reaction. The writers have investigated this possibility and have found that ascorbic acid is a very active catalyst. Table 1 summarizes the results of experiments in which the rate of formation of reducing substances was followed in mixtures of formaldehyde and calcium hydroxide both with and without the addition of ascorbic acid. Ascorbic acid and excess formaldehyde were removed from the solutions before sugar estimations.

TABLE 1

Reactants	Time Minutes	Red. Subs. as glucose mg. per 100 cc
Formaldehyde + ascorbic acid + $Ca(OH)_2$	0	24.
"	30	220.
"	60	391.
"	90	312.
"	120	269.
"	180	199.
Formaldehyde + $Ca(OH)_2$	0	0.
"	60	0.
"	120	11.
"	180	154.
"	240	94.

The disappearance of formaldehyde from the solutions was about complete at the time of maximum reduction.

It will be noted that in the reaction catalyzed by ascorbic acid maximum reduction was attained before the appearance of reducing substances in the control. In both cases the curves show a maximum after which the reducing values decrease. This is possibly due to higher reducing equivalents of the smaller molecules formed early in the reaction followed by polymerization of these to larger molecules of lower reducing values.

Kusin has isolated an intermediate compound of benzoin and formaldehyde from reaction in an alkaline solution. We have obtained evidence that ascorbic acid combines with formaldehyde even in an acid solution. The suggestion has been made that simple sugars play a catalytic rôle in the photosynthetic production of carbohydrates from formaldehyde in green leaves. The evidence presented here suggests that ascorbic acid may be an active photosynthetic catalyst.

Further work is in progress and this, with experimental details, will be published elsewhere.

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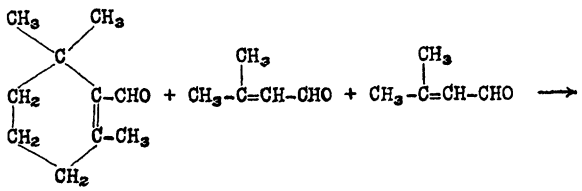
THE CONDENSATION OF β-CYCLOCITRAL WITH DIMETHYLACROLEIN

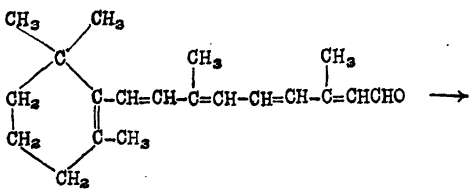
According to the principle of vinylogy[1] the condensation of β-cyclocitral (I) with two moles of

[1] A. Kusin, *Ber.* 68: 619, 1494 and 2169 (1935).

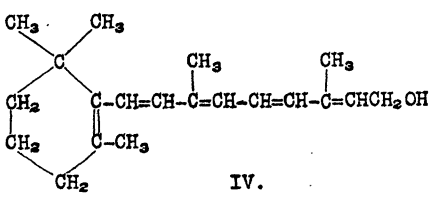
[1] Fuson, *Chem. Rev.,* 16: 1, 1935.



I. II.



III.



IV.

dimethylacrolein (II) should lead to the formation of the aldehyde III. The latter should yield IV when selectively reduced by the method of Ponndorf.[2] This alcohol has the structure ascribed by Karrer, Morf and Schöpp[3] to vitamin A.

We have condensed I with II and subjected the crude reaction product to the action of aluminum isopropoxide. The resulting solution gives a blue color when treated with antimony trichloride in chloroform —which is the standard test for vitamin A.[4] At appropriate dilutions of the synthetic material a color is obtained which is indistinguishable from that given by cod-liver oil.

The ultra-violet absorption spectrum shows a maximum in the region of 328 mμ. Biological tests for vitamin A activity are in progress.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE REGAL LILY AS A SOURCE OF ROOT-TIP MATERIAL

OBSERVATIONS made in our laboratory indicate that the Regal lily (*Lilium regale*) furnishes root tips which are superior to any other generally available material for the study of mitosis. The root tips are secured easily by burying the bulbs in damp moss and keeping them at a temperature between 60 and 70 degrees F. Bulbs which are taken in September are mature and ready to begin growth when placed under favorable conditions. Keeping the bulbs in cold storage at a temperature of 34° F. for a period of three weeks resulted in slightly more rapid sprouting and growth, but did not cause any more root tips to be developed than grew from the bulbs which were not chilled.

The root tips of the lily vary greatly in size, some being only slightly larger than those of the onion, while others have a thickness of 3 to 4 mm. The number of primary root tips is usually small, 5 to 10 per bulb; but if the primary roots are allowed to grow, they soon produce numerous branches from which a much larger number of small tips can be secured.

Measurements of cells in the growing region of the Regal lily root tip show them to average 50 per cent. larger than the cells of the onion, and 20 per cent. larger than those of Tradescantia. The chromosomes and the mitotic figures of the Regal lily are also considerably larger than those of the other two forms. The average of measurements of chromosomes of onion, Tradescantia and Regal lily show a ratio of 1 : 1.28 : 1.44.

The large size of the cells, and their organs, of the Regal lily permits cell structures to be seen with greater readiness than in any other root tips that we have examined. Our experience in the use of these as study material shows that the details of mitosis are more easily observed by students than in onion or Tradescantia root tips.

The Regal lily was discovered by E. H. Wilson growing on the hills of western China at an elevation of 2,500 to 6,000 feet, where seasonal temperatures are extreme, and strong winds blow at all seasons of the year. On being brought into cultivation it has proven to be a hardy and easily grown lily. It is completely fertile, producing large numbers of seeds which give almost 100 per cent. germination, and develop into blossoming plants in two years. The development of the embryo sac, seeds and pollen is normal. The pollen grains sprout readily in sugar solutions, and produce long pollen tubes with accompanying cell divisions. The ease with which the Regal lily can be grown in large numbers, its hardiness and its complete normality make it a useful and convenient plant for study and experiment.

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[2] Ponndorf, *Zeit. angew. Chem.*, 39: 138, 1926.
[3] Karrer, Morf and Schöpp, *Helv. Chim. Acta*, 14: 1431, 1931.
[4] *Pharm. J.*, 126: 466, 1931.