be injected with a hand syringe. The particular material used is "dehydrated nitrocellulose, RS ½ second, viscosity 3.2," obtainable from Hercules Powder Company of Wilmington, Delaware. The lower viscosity product, designated as "RS 18–23 cps.," has also been used, but the resulting preparations are too brittle for practical use. The mass is made up as follows:

nitrocellulose (Hercules RS ½ second)	1,000 grams
acetone (technical grade)	1,000 cc

Solution is accomplished in about twelve hours. The mass may be colored with artists' oil pigments, which are conveniently put into the mass by working up with a small quantity of dioxan.[4] English vermillion is particularly suitable as a color. Acetone soluble stains are much easier to use. Of the microscopic stains commonly available, toluidin blue gives a fairly satisfactory mass and fat soluble brilliant red gives a usable red. These may be dissolved in the acetone before the mass is made or may be added in small quantity of solution subsequently.

Maceration is accomplished as usual, either in concentrated technical hydrochloric acid or by this acid slightly diluted—one part water to five parts acid. If it is desired to retain the bone, maceration in water at body temperature is carried out.

The nitrocellulose as furnished contains 30 per cent. alcohol. With the repeated opening and closing of the container, some of the alcohol is lost; therefore, less quantity of the solid can be used. Moreover, the mass above given represents the maximum viscosity which it has been found practical to inject. Dilution should be practiced as required.

With this material corrosions of the entire vascular system of the adult head have been made, both with and without the destruction of the bone.[5] The material is sufficiently solid so that the corrosions may be handled dry with little fear of breakage. However, they are being mounted in distilled water containing a small amount of formaldehyde.

The costs of the materials used are at this time as follows:

nitrocellulose—10 lb. quantities		$4.08
acetone, technical—5 gal. lots (30 lbs.)	@	.20½ lb.
hydrochloric acid, technical—per carboy (115 lbs.)	@	.05½ lb.

It requires about three days to macerate an adult head. However, sometimes a fourth day with fresh acid is necessary. Small specimens macerate over night.

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SPECIAL ARTICLES

ABSORPTION OF NITRATES BY CORN IN THE DARK

THE effect of light and dark on plants is outside the writer's field of work; but some years ago he blundered into the experiment described below after a discussion with H. A. Allard concerning the "length of day" effect on plants. The question arose whether plants normally absorb ions in the dark. Curiosity on this point was not satisfied by texts on plant physiology; hence an experiment was performed with corn, using nitrate as the ion whose absorption was to be measured. Several previous investigations show that a small amount of nitrate may be absorbed in the dark by plants kept continuously in the dark, but these studies do not show what takes place in plants growing naturally. In the following experiment the plants were grown under the normal condition of an alternation of light and darkness.

Corn plants were grown in nutrient solutions with 7 hours of light and 17 hours of darkness each day. Solutions were renewed or changed twice daily, at the beginning and end of the light period. There were two check lots that received uniform treatment in both light and dark; one was supplied with a complete nutrient solution in both periods and the other with a solution lacking only nitrate. A third lot received the nitrogen-free solution in the light and the complete solution in the dark, while the fourth lot received the complete solution in the light and the nitrogen-free in the dark. The plants were grown in this way for 12 days and then analyzed. Seedlings used in installing the experiment were previously grown for 7 days in a nitrogen-free solution to produce a nitrogen deficiency. Plants receiving nitrate at any period made a good growth and were normal in appearance. Data on growth and nitrogen assimilation are given in Table 1. The experiment is doubtless entitled to more confidence than indicated by the probable errors of the average weights, since, when the experiment was installed, the seedlings were selected for uniformity by fours, one for each treatment; as a result, the 12 seedlings receiving the same treatment were quite variable in size.

The data show quite plainly that corn grown under alternating periods of light and dark is capable of assimilating nitrate fully as well in darkness as in

[4] H. W. Mossman, *Anat. Rec.*, 58: 4, supplement, March, 1934.

[5] A series of specimens so prepared was demonstrated at the College of Physicians, Philadelphia, Pa., January 16, 1935.

TABLE 1

CORN GROWN WITH NITRATE SUPPLIED IN THE LIGHT AND IN THE DARK

When nitrate supplied	Average oven-dry weight per two plants		Ratio of roots / tops	Nitrogen in dry substance of		Nitrogen in two plants	Relative quantities nitrogen absorbed
	tops	roots		tops	roots		
	gm	gm		Per cent.	Per cent.	gm	gm
None at any time	.34 ± .02	.20	.59	1.64	1.19	.0079	0
Both in light and in dark	.62 ± .02	.19	.31	4.49	3.74	.0348	100
In dark only	.63 ± .04	.23	.36	4.21	3.01	.0335	95
In light only	.61 ± .03	.22	.36	3.57	2.68	.0275	73

* Each lot consisted of 6 similarly treated flasks containing two plants each. Data reported are for the average flask of two plants.

light. Further, the root-to-top ratios indicate that the nitrogen requirement was satisfied almost as well by part-time as by continuous exposure to nitrate, for it has been observed that an unfavorable condition for absorbing an essential ion usually produces an increase in the root-to-top ratio.[1] The somewhat smaller quantity of nitrogen assimilated by plants receiving nitrate only in the light, as compared with the quantity taken up by plants receiving nitrate only in the dark, may be due to the comparatively short duration of the light period, 7 hours as compared with the 17 hours of darkness.

Since the plant appears able to take up practically all the nitrogen it needs in complete darkness, it seems that investigations dealing with the influence of light of different intensities and wave-lengths on nitrate absorption are more or less beside the point.[2] Evidently, the effect of light on ion absorption is indirect, the direct effect of light being on carbohydrate synthesis or on changes in organic matter which in turn control ion absorption. This is indicated by experiments of other investigators who found that seedlings and cuttings maintained continuously in the dark absorbed nitrate only in proportion to their carbohydrate or sugar reserves.[3,4,5] Hoagland's[6] experiments with *Nitella,* which took up bromine only in the light, are not necessarily contradictory, since his experimental conditions did not preclude the possibility that bromine absorption was dependent on changes in organic matter that take place only in the light.

That the absorption of an ion may take place in the dark, lagging behind processes which take place in the light, is in harmony with the delayed absorption of ions that necessarily takes place when plants are grown in "fractionated" solutions; that is, grown alternately in different incomplete solutions. Gericke[7] has claimed that plants may grow even better when alternated between a complete solution and a phosphorus-free than when grown continuously in a complete solution.

Whether plants grown under ordinary field conditions usually take up nitrate chiefly in the light or in the dark can be answered certainly only by further experiments. But if the preceding explanation is correct—that nitrate absorption is dependent on synthesis or changes in carbohydrates in the light—it seems that most of the nitrate would be taken up in the light. A lesser part, however, would be taken up in the dark, since the last quantity of organic matter changed in the light would presumably exert a "pull" on nitrates in the dark. The optimum condition for growth would obviously be when nitrates are available both in the light and dark, as shown in the above experiment.

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PERMO-CARBONIFEROUS COAL SERIES RELATED TO SOUTHERN HEMISPHERE GLACIATION

DURING the early Carboniferous (Early Mississippian) there were broad clear inland seas in various parts of the world in which thick masses of limestone accumulated. On top of these limestones is found a series of rocks extending up into the Permian which are of a very different character. These consist of numerous alternations between coarse terrestrial sediments, such as sandstone, arkose and conglomerate, and marine sediments, such as shale and limestone. Such alternations have been called sedimentary cycles. Be-