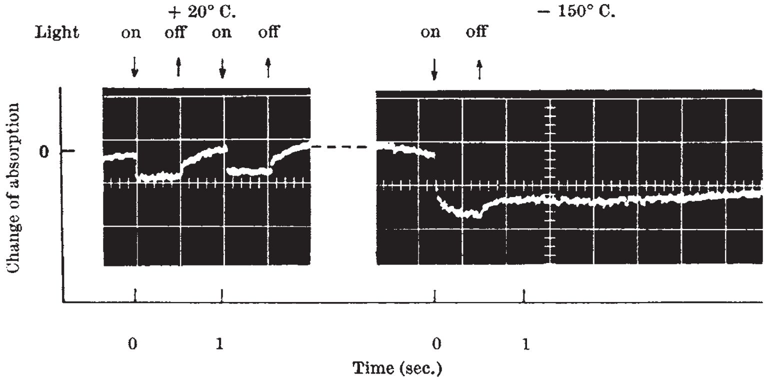

Fig. 1. Changes of absorption at 425 mμ caused by red illumination of chromatophores of spinach

ether. After switching off the light, the absorption changes at ∼ 425 mμ and ∼ 530 mμ, however, are not reversible at − 150° C., that is, a product is trapped at − 150° C. (Only after thawing to 0° C. does a back reaction occur.) These results show that the trapped product is probably one of the two primary products (D^+ or A^-). The course of the negative absorption change as function of wave-length in the range of 425 mμ suggests that the primary product is probably identical with the oxidized form of a cytochrome ($D^+ = \text{cyt}^+$). The small positive change of absorption at ∼ 530 mμ, however, normally does not appear on oxidation of cytochromes. It should be emphasized that the experiments have been carried out with material which was photochemically active after the temperature had been raised from −150° C. to +20° C. (proof by Hill reaction).

An irreversible oxidation of cytochrome at low temperatures in purple bacteria, especially *Chromatium*, has been already reported by Chance and Nishimura[6].

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Fixation of Nitrogen-15 by Excised Nodules of *Discaria toumatou*

Discaria toumatou (Rhamnaceae) has previously been recorded as a nodulated plant in New Zealand[1]. The nitrogen-fixing ability of its nodules has now been studied experimentally.

In these experiments seedlings of *D. toumatou* made no growth in aerated nutrient solutions lacking added nitrogen whether nodules were present or not. In solutions containing 5 p.p.m. nitrogen as nitrate only, plants that were nodulated grew normally, non-nodulated plants becoming moribund.

Nodulated plants of *Coriaria arborea*, in contrast, made normal growth in aerated nutrient solutions lacking added nitrogen, but became moribund when nodules were absent. Previous work has shown that excised nodules of this plant are able to fix atmospheric nitrogen[2].

Experiments in which excised nodules of *Discaria* were exposed to an atmosphere enriched with nitrogen-15 have also been carried out. Some nodules for these experiments were obtained from plants dug in the field. The roots were washed free of soil and transferred within 2 hr. to flasks containing an aerated nutrient solution lacking added nitrogen. They remained in this solution for two days before nodules were excised and exposed to nitrogen-15. Other nodules were obtained from plants of *Discaria* growing in aerated nutrient solution containing 5 p.p.m. nitrate nitrogen. Excised nodules of *Coriaria arborea* were exposed to nitrogen-15 at the same time. These were obtained from plants growing in aerated nutrient solutions as shown in Table 1.

All nodules were exposed for 40 hr., as previously described[2], to an atmosphere containing 90 per cent nitrogen enriched with 32 atoms per cent excess nitrogen-15. Nitrogen was then extracted with 3*N* hydrochloric acid.

Table 1. ENRICHMENT OF EXCISED NODULES FROM ATMOSPHERE CONTAINING NITROGEN-15

	Nitrogen-15 enrichment (atoms per cent excess)
Discaria from soil	0·10
Discaria from 5 p.p.m. nitrogen solution	0·095
Coriaria from solution lacking nitrogen	> 0·2
Coriaria from 5 p.p.m. nitrogen solution	0·22
Coriaria from 40 p.p.m. nitrogen solution	0·33

These experiments provide evidence that nodules of *Discaria toumatou* are capable of fixing atmospheric nitrogen. Under the conditions employed, however, they differed from those of *Coriaria arborea* in being unable to supply the plant's total need of nitrogen.

In the field *Discaria* grows quite differently from what it does in solutions: it is spiny and almost leafless. One would suppose that this type of growth uses less nitrogen, and it is therefore possible that the nodules can support the growth of *Discaria* in Nature and, perhaps, even that of its usual associates such as sweet briar (*Rosa rubiginosa*).

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