evidence to suggest that this property was less sensitive to chymotryptic than to tryptic digestion of myosin under the conditions employed.

3. Under the conditions of low ionic strength at which magnesium-activation of the adenosine triphosphatases occurred the acto-H-meromyosin systems were soluble and viscometric measurements suggested dissociation into actin and mero-myosin.

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Rapidity of Carotene Biosynthesis in *Narcissus*

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The highest concentration of β -carotene recorded in biological material (Booth, 1957*a*) is believed to be that in the deep-red fringe of the corona of *Narcissus majalis* Curtis (pheasant's-eye narcissus). Evidence is presented in this paper that the carotene is produced in a few days during the development of the flower.

MATERIAL AND METHODS

N. majalis plants were grown from bulbs out-of-doors at Cambridge.

A criterion was needed for recognizing and numerically recording the stage of development at which flowers were taken for analysis. The most precise single event was the opening of the bud. But analyses were necessarily done before this event occurred, and different plants reached this stage of maturity on different dates. The dates of

analysis were therefore converted into a system of day numbers. Zero day for each flower was that on which the perianth opened to display the corona. The development of several buds was observed until they opened. Measurements were recorded and sketches were made daily: the angular position of the bud on the stem, and the distance between the middle of the ovary and the base of the corona, were especially characteristic. These observations were used to estimate the number of days to blooming of other buds that were analysed, and hence destroyed, before opening.

β -Carotene was extracted from individual coronas with acetone and light petroleum (Booth, 1959*a*), chromatographed on aluminium oxide plus sodium sulphate, and determined spectrophotometrically (Booth, 1957*b*).

RESULTS

Observations were made in 4 successive years, and 32 coronas were analysed. The results are summarized in Fig. 1, on which each spot represents an

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Fig. 1. Time-course of the development and decline of the β -carotene content of *Narcissus* flowers. Day 0 was, for each plant, the flowering date, inferred for buds (–) or actual for flowers (+). The representation of the flower head is diagrammatic only, and not to scale.

average of three analyses. The pooled s.e.m. was estimated to be ± 6.5 $\mu\text{g.}$ of β -carotene per corona.

The maximum β -carotene content of 157 $\mu\text{g.}$ per corona was reached immediately before the perianth opened. Thereafter the carotene content declined, presumably by photo-oxidation (Booth, 1959b).

The cups or coronas of *N. majalis* are much smaller than those of other varieties. The pigment is contained in the rim or outer fringe of the corona. This coloured fringe decreased in weight shortly before the flower opened. At day –1 it was less than 1 mm. wide and contained about 1 mg. of dry matter.

The greater part of the coronal pigment behaved chromatographically as β -carotene, and in *n*-hexane it had spectral absorption maxima at 429, 450 and 478 m μ . Fuller evidence for the identity has already been presented (Booth, 1957a).

Mustard. Leaves of *Sinapis alba* from 10-day-old seedlings were analysed for carotene and found to contain 0.67 $\mu\text{g./mg.}$, based on dry matter.

DISCUSSION

During the day before the flower opened the β -carotene content rose from 87 to 157 $\mu\text{g.}$ per corona: thus 70 $\mu\text{g.}$ of β -carotene per bud was synthesized and stored in the coronal fringe. The dry weight of a fringe only was about 1 mg. Hence the increase in concentration in 1 day was 70 $\mu\text{g./mg.}$

Comparison with the carrot is instructive. The roots of commonly grown cultivars of *Daucus carota* in early summer had total carotenoid contents of 0.05 $\mu\text{g./mg.}$, based on fresh weight (Booth & Dark, 1949), or 0.5, based on dry matter. The concentration increased to 1.0 $\mu\text{g./mg.}$ in 63 days, and β -carotene represented about half the total carotenoids (Booth, 1947). Therefore the net accretion rate for β -carotene was 0.25 $\mu\text{g./mg.}$ in 63 days or 0.004 $\mu\text{g./day.}$ This rate is less than a ten-thousandth of the rate in the coronal fringe of *N. majalis*.

S. alba is one of the fastest-growing temperate plants. The leaf developed a carotene content of 0.67 $\mu\text{g./mg.}$ in 10 days, or 0.067 $\mu\text{g./day}$, which is one-thousandth of the rate for the narcissus corona. However, comparison between flower and leaf is less appropriate than between flower and root because carotene is probably non-functional in both the latter tissues.

SUMMARY

1. The β -carotene concentration in the red fringe of the corona of *Narcissus majalis* increased rapidly immediately before the flower opened. The maximum accretion rate was about 70 $\mu\text{g./mg.}$ of dry matter/day, or over 10 000 times the rate for the carrot root.

I am grateful to Mr K. C. Day for suggesting suitable measurements to characterize the stage of the developing buds.

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