Aeshna grandis, mostly two years, but in peat bogs of Breitebruch three years (p. 198), from overwintered eggs.

Ae. viridis, in non-peaty ponds two years as a rule (p. 203), in a peat brook, separated from the ponds by only a few hundred meters, more often three years (p. 204), from overwintered eggs (p. 201).

Ae. cyanea, two years as a rule, from overwintered eggs (p. 207).

Ae. subarctica, four years as a rule, three years as a minimum, from probably overwintered eggs (p. 210).

Ae. mixta, one year, from overwintered eggs (pp. 211–214).

Lucas,[5] largely on the basis of earlier work by East, lists 12 ecdyses for *Aeshna cyanea* in captivity in England, but adds: "Probably the first moult immediately after hatching is omitted and possibly the next also." On the supposition that eggs overwintered and hatched in the spring, the dates given indicate that larval life occupied perhaps 14 months (pp. 51–52). East, he says, "succeeded in making certain that it requires two seasons to reach maturity; but individual specimens sometimes develop abnormally at a slower rate, and it seems clear that there is not quite absolute fixity in the matter. As regards the first winter we are uncertain, and possibly the eggs laid in the autumn may remain dormant during that period and hatch in the spring. It may be, however, that the earlier laid eggs hatch in the autumn, the late ones in the spring, and this may account for irregularity in size at the same date in this and other species that have a long life as imagines; for emergence of *Ae. cyanea* usually commences late in June or early in July, while egg-laying may take place during August, September, and even October."

In view of the gaps and divergences in the development of the insects described in these preceding accounts, it is of interest to state briefly the results obtained from rearing four individuals of *Aeshna tuberculifera,* a North American species, from egg to, or almost to, imago. This species, known from Maine, Ontario and Wisconsin south to Connecticut, New York and Indiana, had not been recorded from Pennsylvania previous to the writer's taking ten males and two females at Smithson's Pond, near Cheyney, Delaware County, Pennsylvania, on five days, September 8 to 27, 1935. One of the females was taken pairing, brought home alive and on the following day (September 16) laid eggs in a leaf of cat-tail (*Typha*). Three lengths of *Typha* leaf containing the oviposition punctures were placed in a jar containing some water, some of the punctures being below, some above, the water's surface. The jar, the three pieces of leaf and water, the last renewed at intervals, were kept in my study, a moderately heated room, and examined from time to time during the winter. On March 13, 1936, the first living, active larva was found in the water. Between this date and April 5, 85 larvae were obtained. I attempted to rear 33 of them, the remainder being used for other purposes. Two of these transformed to imagos on July 27 and August 3, 1937, respectively, both males, the former as its *thirteenth* larval moult, the latter as its *fifteenth* larval moult. Two female larvae died, without transforming, on June 7 and July 17, 1937, respectively, both of them having completed fourteen larval moults; had they lived to adulthood each would, of course, have made at least one more moult.

Each larva of *tuberculifera* was reared in a separate container by the methods employed for *Anax junius* (Calvert 1929).[6] The conditions under which these four, and other shorter lived, *tuberculifera* were kept appear to have been identical, so that the differences in the number of moults do not seem to be due to environment.

A detailed account of these larvae of *tuberculifera,* their growth and development, is in preparation by Miss Elsie Lincoln.

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[5] "The Aquatic (Naiad) Stage of the British Dragonflies (Paraneuroptera)." Ray Society, No. 117, pp. xii, 132, 35 pls., 1930.

A PHYSIOLOGICAL STUDY OF THE RIND COLOR OF CERTAIN CITRUS FRUITS

DURING the course of an investigation of the physiological effects of ethylene on citrus fruits in Florida it was noted that carotenoid pigments were present in the rinds of limes, lemons and grapefruit which were mature but still green. This would ordinarily not be considered unusual, since carotenoids are known to be present in green oranges though masked by the presence of chlorophyll. It is significant, however, that these plastid pigments diminish in quantity, and sometimes disappear, as the light-colored citrus fruits attain full color. The above is true, whether the fruit be degreened by ethylene or permitted to degreen on the tree. This is illustrated in Tables 1 and 2.

TABLE 1

CAROTENOID CONTENT OF THE RIND OF GREEN-COLORED AND ETHYLENE-DEGREENED CITRUS FRUITS OF SIMILAR MATURITY

Variety	Mature green (Control)		Degreened with ethylene	
	Carotene (mgs per 100 gms fresh peel)	Xanthophyll (mgs per 100 gms fresh peel)	Carotene (mgs per 100 gms fresh peel)	Xanthophyll (mgs per 100 gms fresh peel)
Villa Franca lemon	.085	.830	.030	.360
Grapefruit (Duncan type).	.150	1.040	.075	.510
Persian limes ...	.180	1.850	.055	.470
Perrine lemons ..	.065	.670	.025	.275
Key limes	.100	1.090	.095	.480

[6] *Proc. Am. Phil. Soc.,* 68 (3): 227–274, 1929.

TABLE 2

CAROTENOID CONTENT OF THE RIND OF MATURE GREEN AND TREE-DEGREENED (FULL-COLORED) CITRUS FRUITS

Variety	Mature green		Degreened on tree (Full colored)	
	Carotene (mgs per 100 gms fresh peel)	Xanthophyll (mgs per 100 gms fresh peel)	Carotene (mgs per 100 gms fresh peel)	Xanthophyll (mgs per 100 gms fresh peel)
Villa Franca lemon	.085	.830	.060	.275
Grapefruit (Duncan type)	.045	.435	.004	.000
Persian limes	.045	.500	.010	.000
Perrine lemons	.065	.670	.020	.160
Key limes	.100	1.090	.055	.310

Recently Zechmeister[1] and Tuzson have shown that in the determination of carotenoids in orange peel the epiphasic petroleum ether layer contains mostly cryptoxanthin. However, since cryptoxanthin has not been reported in limes, lemons and grapefruit, the conventional method of expressing the results as carotene and xanthophyll is employed for this type of fruit.

Most of the yellow substances in the rind of the full-colored limes, lemons and grapefruit were washed out of the extract by the dilute sodium carbonate solution which is employed to remove the flavone pigments. Schunck[2] reported that the yellow pigment in the lemon rind consisted principally of a water-soluble pigment together with the acid derivatives of two xanthophylls. From the context it is evident that the author referred to ripe lemons. Hardy and Warneford[3] noted "the almost entire absence of chromoplasts in the rind cells" of limes but apparently did not analyze the green fruit. These authors reported that the color was due to the presence of a phlobatannin and stated that in this respect the lime resembles the lemon and grapefruit.

The above results are in striking contrast to those found in the analysis of orange rinds in the present investigation. Carotenoids are present in the rinds of mature green oranges, and they increase as the fruit ripens. Inasmuch as a more detailed report will appear elsewhere only one example is presented here (Table 3). These analyses were made while the fruit was still green in color but legally mature according to state and federal standards, when it was yellow (just before commercial picking), and again about two months after the fruit of the adjoining trees had all been picked for the market.

If the underlying cause for this phenomenon were known it might help explain the great variation in color of citrus fruits grown in different sections of the country or even in different sections of the same state.

TABLE 3

CAROTENOID CONTENT OF THE RIND OF PARSON BROWN ORANGES DURING RIPENING

Date sampled	Rind color	Sugar/acid ratio of juice	Total carotenoids (mgs per 100 gms fresh peel)
September 28	Near* Parrot green	9.38	1.045
December 1	Yellow ochre	14.64	2.470
February 1	Near Ochraceous orange	27.50	5.340

* Ridgway's Color Chart.

1 L. Zechmeister and P. Tuzson, *Berichte der deutschen chemischen Gesellschaft*, 69 (8): 1878–1884, 1936.

2 C. A. Schunck, *Proc. Roy. Soc. London*, 1903: 165–176, 1904.

3 F. Hardy and F. H. S. Warneford, *Indust. and Eng. Chem.*, 17 (1): 48–50, 1925.

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THE MOLECULAR WEIGHTS OF UREASE, CANAVALIN, CONCANAVALIN A AND CONCANAVALIN B[1]

THE jack bean, *Canavalia ensiformis,* contains four crystallizable globulins, urease, canavalin, concanavalin A and concanavalin B. The first of these is an enzyme, while the third is a hemagglutinin. In this paper we describe briefly the determination of the molecular weights of these four globulins. The results and methods used will be given in a later publication.

Urease was prepared from jack-bean meal; some was recrystallized once and some twice. We centrifuged six preparations of varying degrees of purity in the Svedberg ultra-centrifuge. All preparations contained a main constituent with a sedimentation constant of approximately 19×10^{-13}, and one preparation was nearly free from impurity.

Determination of the diffusion constant for urease was especially difficult because the urease became opalescent upon standing even at 0° and eventually precipitated from solution. However, by dissolving in neutral phosphate containing a mixture of $NaHSO_3$ and Na_2SO_3 the urease was stabilized and we were able to determine the diffusion constant as well as the partial specific volume.

Crystals of concanavalin A, concanavalin B and

TABLE I

Protein	$s_{20} \times 10^{-13}$	$D_{20} \times 10^{-7}$	Partial specific volume	Molecular weight
Urease	18.6	3.46	0.73	473,000
Canavalin	6.4	5.1	0.73	113,000
Concanavalin A	6.0	5.6	0.73	96,000
Concanavalin B	3.49	7.4	0.73	42,000

1 From the Institute of Physical Chemistry, The University, Upsala, Sweden.